

**United States Department of the Interior
Bureau of Land Management**

**Environmental Assessment
for the May 2016 Competitive Oil & Gas Lease Sale**

Little Snake Field Office
455 Emerson St
Craig, CO 81625

White River Field Office
220 E Market St
Meeker, CO 81641

DOI-BLM-CO-N050-2015-0092-EA

February 2016



TABLE OF CONTENTS

Contents

CHAPTER 1 - INTRODUCTION.....	3
1.1 IDENTIFYING INFORMATION.....	3
1.2 PROJECT LOCATION AND LEGAL DESCRIPTION.....	4
1.3 PURPOSE AND NEED	4
1.3.1 Decision to be Made	4
1.4 PUBLIC PARTICIPATION.....	5
1.4.1 Scoping	5
1.4.2 Public Comment Period.....	6
CHAPTER 2 - ALTERNATIVES	6
2.1 INTRODUCTION.....	6
2.2 ALTERNATIVES ANALYZED IN DETAIL.....	7
2.2.1 No Action Alternative.....	7
2.2.2 Preferred Alternative.....	7
2.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL	7
2.4 PLAN CONFORMANCE REVIEW	8
CHAPTER 3 – AFFECTED ENVIRONMENT AND EFFECTS	8
3.1 INTRODUCTION	8
3.2 ENVIRONMENTAL CONSEQUENCES OF THE NO ACTION ALTERNATIVE.....	9
3.3 PAST, PRESENT AND REASONABLY FORESEEABLE ACTIONS	9
3.4 ENVIRONMENTAL CONSEQUENCES OF LEASING AND POTENTIAL DEVELOPMENT	14
3.4.1 Physical Resources.....	14
3.4.2 Biological Resources	44
3.4.3 Heritage Resources and Human Environment.....	64
3.4.4 Resource Uses	75
CHAPTER 4– COORDINATION AND CONSULTATION	80
Attachment A – All Nominated Parcels.....	82
Attachment B – Recommended Parcel Deferrals	88
Attachment C – Preferred Alternative Parcels with Stipulations for Lease.....	94
Attachment D – Stipulation Exhibits	97
Attachment E – Maps.....	111
Attachment F – Response to Public Comments.....	118

CHAPTER 1 - INTRODUCTION

1.1 IDENTIFYING INFORMATION

BACKGROUND:

It is the policy of the Bureau of Land Management (BLM) as derived from various laws, including the Mineral Leasing Act of 1920 (MLA) and the Federal Land Policy and Management Act of 1976 (FLPMA), to make mineral resources available for disposal and to encourage development of mineral resources to meet national, regional, and local needs.

BLM's Colorado State Office conducts quarterly competitive sales to lease available oil and gas parcels. A Notice of Competitive Lease Sale, which lists lease parcels to be offered at the auction, is published by the Colorado State Office at least 90 days before the auction is held. Lease stipulations applicable to each parcel are specified in the Sale Notice. The decision as to which public lands and minerals are open for leasing and what leasing stipulations may be necessary, based on information available at the time, is made during the land use planning process. Constraints on leasing and any future development of split estate parcels are determined by BLM in consultation with the appropriate surface management agency or the private surface owner.

In the process of preparing a lease sale, the Colorado State Office sends a draft parcel list to each field office where the parcels are located. Field Office staff then review the legal descriptions of the parcels to determine if they are in areas open to leasing and that appropriate stipulations have been included; verify whether any new information has become available that might change any analysis conducted during the planning process; confirm that appropriate consultations have been conducted; and identify any special resource conditions of which potential bidders should be made aware. The nominated parcels are posted online for a 30 day public scoping period. This posting also includes the appropriate stipulations as identified in the relevant Resource Management Plan (RMP). BLM prepares an analysis consistent with the National Environmental Policy Act (NEPA), usually in the form of an Environmental Assessment (EA). Comments received from the public are reviewed and incorporated into the NEPA document, as applicable.

After the Field Office completes the draft parcel review and NEPA analysis and returns them to the State Office, a list of available lease parcels and associated stipulations is made available to the public through a Notice of Competitive Lease Sale (NCLS). Lease sale notices are posted on the Colorado BLM website at:

http://www.blm.gov/co/st/en/BLM_Programs/oilandgas/oil_and_gas_lease.html. On rare occasions, BLM may defer or withhold additional parcels prior to the day of the lease sale. In such cases, BLM prepares an addendum to the sale notice.

If the parcels are not leased at the May 2016 lease sale, then they will remain available to be leased for a period of up to two years to any qualified lessee at the minimum bid cost. Parcels obtained in this way may be re-parceled by combining or deleting other previously offered lands. Mineral estate that is not leased within a two-year period after an initial offering will no longer be available, and must go through a competitive lease sale process again prior to being leased.

The act of leasing does not authorize any development or use of the surface of lease lands, without further application by the operator and approval by BLM.

In the future, BLM may receive Applications for Permit to Drill (APDs) for those parcels that are leased. If APDs are received, BLM conducts additional site-specific NEPA analysis before deciding whether to approve the APD, and what conditions of approval (COAs) should apply.

Twenty parcels comprising 15,773.30 acres within the Little Snake Field Office (LSFO) and White River Field Office (WRFO) were nominated for the May 2016 Competitive Oil and Gas Lease Sale. A portion of two of the parcels are in WRFO, the rest in LSFO. This figure is comprised of 14,894.08 acres of federal land and 879.22 acres of split estate land. The legal descriptions of the nominated parcels are in Attachment A.

This EA documents the review of the nominated parcels under the administration of the LSFO and WRFO. It serves to verify conformance with the approved land use plans, and provides BLM's recommendation to offer or to defer particular parcels from a lease sale.

In accordance with BLM Colorado Instruction Memorandum (IM) No. 2012-027 and BLM Washington Office IM No. 2010-117, this EA has been released for 30 days of public comment. Any comments received within the 30-day timeframe have been considered and incorporated into the EA as appropriate.

1.2 PROJECT LOCATION AND LEGAL DESCRIPTION

LEGAL DESCRIPTION:

Please see Attachments A, B, and C for legal descriptions, and Attachment E for maps.

1.3 PURPOSE AND NEED

The purpose of the Proposed Action is to consider opportunities for private individuals or companies to explore and develop oil and gas resources on specific public lands through a competitive leasing process.

The need for the action is to respond to the nomination or expression of interest for leasing, consistent with BLM's responsibility under the Mineral Leasing Act (MLA), as amended, to promote the development of oil and gas on the public domain. Parcels may be nominated by the public, BLM or other agencies. The MLA establishes that deposits of oil and gas owned by the United States are subject to disposition in the form and manner provided by the MLA under the rules and regulations prescribed by the Secretary of the Interior, where consistent with FLPMA and other applicable laws, regulations, and policies.

1.3.1 Decision to be Made

BLM will decide whether to lease the nominated parcels and, if so, under what terms.

1.4 PUBLIC PARTICIPATION

1.4.1 Scoping

The principal goal of scoping is to identify issues, concerns, and potential impacts that require detailed analysis. BLM uses both internal and external scoping to identify potentially affected resources and associated issues.

Internal scoping was conducted through meetings of an interdisciplinary (ID) team of resource specialists and discussion of the nominated parcels. The following issues were identified:

How might the proposed action affect air quality and climate?

How might the proposed action affect flood plains?

How might the proposed action affect ground or surface hydrology?

How might the proposed action affect minerals and geology?

How might the proposed action affect soils?

How might the proposed action affect groundwater or surface water quality?

How will the project affect invasive non-native species introduction?

How will the native landscape/rangesites be affected by the project?

How might the proposed action and development affect cultural resources in the area?

How might the proposed action and development affect paleontological resources in the area?

How might the proposed action affect social and economic conditions?

How might the proposed action affect management of hazardous or solid wastes?

How might the proposed action affect visual resources?

How might the proposed action affect access and transportation?

How might the proposed action be expected to influence nesting behavior and nest habitat of migratory birds and modify the composition and abundance of the breeding bird community?

How might the proposed action affect the condition and utility of Columbian sharp-tailed grouse habitat?

How might water depletions attributable to lease development be addressed in terms of the Yampa River's endangered fish populations and habitat?

To what degree and in what manner might the proposed action influence on-lease and downstream riparian and higher-order (e.g., vertebrate) aquatic communities?

To what degree and in what manner might the proposed action be expected to modify the physical nature and functional utility of big game, raptor, and greater sandhill crane habitat and exert behavioral influences on important seasonal uses?

External scoping was conducted by posting the nominated lease parcels and stipulations from the RMP for 30 days: from August 10, 2015 to September 9, 2015. Stipulation summaries, GIS shapefiles, and maps were posted on the BLM Colorado State Office website:

http://www.blm.gov/co/st/en/BLM_Programs/oilandgas/oil_and_gas_lease/20160/march_2016.html.

This external scoping process gave the public an opportunity to provide comments, which BLM considered and incorporated into the EA as appropriate. BLM sent letters to surface owners of the two proposed parcels whose land overlies federal minerals proposed for leasing. BLM received one comment letter, from Colorado Parks and Wildlife (CPW), stating it had no concerns with the project. No additional issues were identified during public scoping.

BLM considered several issues raised during internal project scoping. After review of available information, the ID Team determined that the following issues are not present on the parcels and did not have the potential to be impacted by any of the alternatives and therefore are dismissed from detailed analysis:

Areas of Critical Environmental Concern
Land with Wilderness Characteristics
Prime and Unique Farmlands
Realty Authorizations and Land Tenure
Scenic Byways
Threatened, Endangered or BLM Sensitive Plant Species
Wild Horses
Wilderness and Wilderness Study Areas

The following resources may be present, however impacts are anticipated to be slight to nonexistent and therefore are dismissed from detailed analysis:

Fire Management
Forestry
Livestock Operations
Recreation

1.4.2 Public Comment Period

The EA and unsigned Finding of No Significant Impact (FONSI) were available for public review and comment for a 30 day period beginning November 12, 2015 and ending December 14, 2015. The document was available online at http://www.blm.gov/co/st/en/BLM_Programs/oilandgas/oil_and_gas_lease/20160/march_2016.html and in the public room at both the Little Snake and White River Field Offices.

Issues Identified: BLM received six letters as a result of this comment period (five within the deadline, and one late). These letters provided BLM information on the concerns of the public. BLM responses to these comments are included as Attachment F.

In addition, BLM and CPW personnel visited Parcel 7416 with the private landowner on December 7, 2015, to discuss resource concerns and the oil and gas development process. This feedback was considered during the analysis process.

CHAPTER 2 - ALTERNATIVES

2.1 INTRODUCTION

This chapter describes the alternatives analyzed in detail. Alternatives considered but not analyzed in detail are also discussed.

2.2 ALTERNATIVES ANALYZED IN DETAIL

2.2.1 No Action Alternative

In an EA, the No Action Alternative typically means that the Proposed Action would not take place. See BLM NEPA Handbook (H-1790-1).

Under the No Action Alternative, BLM would defer all nominated lease parcels from the May 2016 lease sale. The parcels could be considered for inclusion in future lease sales. Surface management would remain the same and ongoing oil and gas development would continue on surrounding private, state, and federal leases.

2.2.2 Preferred Alternative

Under the preferred alternative, BLM would offer for lease **2** parcels, for a total of **813.07** acres, entirely on split-estate land within LSFO (Parcels 7416 and 7429). BLM would defer **18** parcels comprised of **14,960.23 acres** from the sale.

Attachment B lists all parcels or portions of parcels that would be deferred from the lease sale under the preferred alternative. Attachment C lists all parcels that would be offered for lease under the preferred alternative with applied stipulations. Attachment D contains descriptions of the applicable stipulations, and Attachment E contains maps of the parcels.

Deferral of nominated parcels allows BLM to address situations in which legitimate questions or controversy has arisen over the leasability of a parcel. Deferral does not withdraw a parcel from potential future leasing, but indicates that further analysis is needed before possible inclusion in a future lease sale. Section 2.3 further describes the rationale to defer the 18 parcels.

2.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

BLM considered, but dismissed from detailed analysis, an alternative that would lease Federal mineral estate in all nominated parcels available for leasing in the resource area in accordance with the Little Snake Field Office RMP (Little Snake RMP) (October 2011) and White River Field Office RMP as amended (White River RMPA), (August 2015). The current lease sale includes 19 parcels in Moffat County and 1 parcel in Routt County. Those lands proposed for lease under this alternative total 15,773.30 acres of federal mineral estate and include a combination of federal and private surface (see Attachment A). The lands have been grouped into appropriate lease parcels for competitive sale as oil and gas leases in accordance with the 43 CFR 3100 regulations. The leases would include the standard lease terms and conditions for development of the surface of oil and gas leases provided in 43 CFR 3100. Stipulations to protect other surface and subsurface resources would apply, as prescribed by the RMPs.

Under recent policy, BLM Colorado deferred leasing of nominated parcels that fall within Preliminary Priority Habitat for Greater Sage-Grouse while the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment was being prepared (See BLM Instruction Memorandum 2012-043, dated 12/22/2011). The Record of Decision (ROD) and Approved Resource Management Plan Amendments for the Rocky Mountain Region (including Northwest Colorado) (ARMPA) was signed by the Assistant Secretary of the Interior for Land and Minerals

Management on September 21, 2015. The ARMPA identifies and incorporates appropriate measures in land use plans to conserve, enhance, and restore Greater Sage-Grouse habitat in the context of BLM's multiple use and sustained yield mission under FLPMA.

Eighteen of the twenty nominated parcels fall within Priority or General Habitat Management Areas for Greater Sage-Grouse. BLM already had begun preparation of this EA, assuming the deferral of these 18 parcels, when the ARMPA ROD was signed. While these parcels could potentially be leased under the management decisions set forth in the ARMPA; it was not feasible to add analysis of a leasing alternative for these parcels at that point in the sale process. BLM's policy governing the lease sale process establishes a strict timeline that does not allow flexibility. The eighteen deferred parcels could be analyzed for inclusion in a future lease sale with the stipulations and restrictions identified in the ARMPA.

No other alternatives to the proposed action were identified that would meet the purpose and need of the proposed action.

2.4 PLAN CONFORMANCE REVIEW

The proposed action was reviewed for conformance (43 CFR 1610.5-3) with the following plan:

Name of Plan: Little Snake Record of Decision and Resource Management Plan as amended by the Northwest Colorado Greater Sage-Grouse Approved Resource Management Plan Amendment (Little Snake RMP)

Date Approved: October 2011, amended September 2015

Decision Language: The 2011 Little Snake RMP designated approximately 1.7 million acres of federal mineral estate open for continued oil and gas development and leasing. The RMP also describes specific stipulations that would be attached to new leases offered in certain areas. Under the action alternatives, parcels to be offered would be leased subject to stipulations prescribed by the RMP. Therefore, the alternatives considered conform to the fluid mineral leasing decisions in the RMP, and are consistent with the RMP's goals and objectives for natural and cultural resources.

CHAPTER 3 – AFFECTED ENVIRONMENT AND EFFECTS

3.1 INTRODUCTION

The CEQ Regulations state that NEPA documents “must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail” (40 CFR 1500.1(b)). While many issues may arise during scoping, not all of the issues raised warrant analysis in an EA. Issues will be analyzed if: 1) an analysis of the issue is necessary to make a reasoned choice between alternatives, or 2) if the issue is associated with a significant direct, indirect, or cumulative impact, or where analysis is necessary to determine the significance of the impacts.

The following resources and management issues were determined to not be present or not expected to be substantially impacted by the proposed action and alternatives:

Areas of Critical Environmental Concern

Fire Management

Forestry

Land with Wilderness Characteristics

Livestock Operations

Prime and Unique Farmlands

Realty Authorizations and Land Tenure

Recreation

Scenic Byways

Threatened, Endangered or BLM Sensitive Plant Species

Wild Horses

Wilderness and Wilderness Study Areas

3.2 ENVIRONMENTAL CONSEQUENCES OF THE NO ACTION ALTERNATIVE

The No Action Alternative is used as the baseline for comparison of the alternatives. Under the No Action Alternative, the 20 parcels totaling 15,773.3 acres would not be leased. There would be no subsequent impacts from oil and/or gas construction, drilling, and production activities. The No Action Alternative would result in the continuation of the current land and resource uses in the proposed lease areas.

BLM assumes that the No Action Alternative (no lease option) may result in a slight reduction in domestic production of oil and gas. This reduction would diminish federal and state royalty income, and increase the potential for federal lands to be drained by wells on adjacent private or state lands. The public's demand for oil and gas is not expected to change; oil and gas consumption is driven by a variety of complex interacting factors including energy costs, energy efficiency, availability of other energy sources, economics, demographics, and weather or climate. If the parcels are not leased, energy demand would continue to be met by other sources such as imported fuel, alternative energy sources (e.g., wind, solar), and other domestic fuel production. This displacement of supply could offset any reductions in emissions and disturbance achieved by not leasing the subject tracts in the short term.

3.3 PAST, PRESENT AND REASONABLY FORESEEABLE ACTIONS

NEPA requires federal agencies to consider the cumulative effects of proposals under their review. Cumulative effects are defined in the Council on Environmental Quality (CEQ) regulations 40 CFR §1508.7 as “the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency . . . or person undertakes such other actions.” In its guidance, the CEQ has stated that the “cumulative effects analyses should be conducted on the scale of human communities, landscapes, watersheds, or airsheds” using the concept of “project impact zone” (i.e., the area that might be influenced by the proposed action).

Offering and issuing leases for the subject parcels, in itself, would not result in cumulative impacts to any resource. Nevertheless, future development of the leases could be an indirect effect of leasing. The Little Snake RMP/EIS (2011) and the EIS for the 2015 ARMPA (BLM 2015b) provide BLM's analysis of cumulative effects of oil and gas development based on the reasonable, foreseeable oil and gas development scenario. Those analyses are hereby incorporated by reference and are available at http://www.blm.gov/co/st/en/fo/lsfo/plans/rmp_revision/rmp_docs.html and <https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage¤tPageId=48134>. The cumulative impacts analysis in EISs accounted for the potential impacts of development of lease parcels in the planning area as well as past, present and reasonably foreseeable actions known at that time. This analysis expands upon those analyses by incorporating new information.

The Cumulative Impact Analysis Area (CIAA) for most resource analysis is outlined by the Natural Resources Conservation Service (NRCS) 5th Level Watershed around each parcel (Williams Fork and Slater Creek watersheds). Past, present and reasonably foreseeable actions in these two watersheds are described below, spanning the timeframe from FLPMA (1976) through the twenty year expected life of the current Little Snake RMP (approximately 2031). A few resources analyze impacts using a different CIAA: air quality and climate, migratory birds, and paleontological resources are analysed through the 4.2 million acre LSFO area in northwest Colorado, and social and economic conditions are analyzed in Routt and Moffat Counties (a combined 4.5 million acres). In addition, BLM's air quality and climate analysis considered cumulative impacts through 2021 rather than 2031.

The following activities will be considered in the cumulative impacts analysis of each alternative: livestock grazing, recreation, hunting, invasive weed inventory and treatment, grazing, range improvement projects (including water developments, fences, and cattle guards), wildfire and emergency stabilization/rehabilitation, oil and gas development (including well pads, access roads, pipelines, gas plant and other facilities), and vegetation treatments.

Past Actions

Parcel 7416

Around Parcel 7416, the CIAA is the 110,000 acre Williams Fork Creek watershed, which is comprised of about 72% private, 16% BLM, 10% Forest Service, and 2% state surface. Highways 13 and 317, and the unincorporated community of Hamilton are within the CIAA. Trapper Mine, one of Colorado's largest coal producers, is located along the northern boundary. There are about 24 miles of paved roads within the CIAA. The CIAA is an area mapped as High potential for oil and gas development (Little Snake RMP). Most of the federal minerals have already been leased, and private minerals have also been developed. There are about 200 present and historical wells; the earliest well was drilled in 1924 (COGCC).

Prior activities on federal land in the CIAA include grazing, recreation (primarily hunting), agriculture, mining (particularly coal mining), energy and realty development. Activities on the private land appear to include grazing, hunting and residential development.

Parcel 7429

Around Parcel 7429, the CIAA is the 97,000 acre Slater Creek watershed, which is comprised of about 49% Forest Service, 44% private and 7% BLM surface (Figures 3-1 and 3-2). There are no paved roads within the CIAA. The CIAA for Parcel 7429 is an area mapped as High potential for oil and gas development. About 20% of the area has already been leased for federal minerals. There are less than 20 historical wells in the area; the earliest was drilled in 1977.

Prior activities on federal land in the CIAA includes grazing, recreation (primarily hunting), agriculture, energy and realty development. Activities on the private land appear to include grazing, hunting and residential development.

Present Actions

Current activities on federal land in the CIAAs include grazing, recreation (primarily hunting), agriculture, mining, energy and realty development. Activities on the private land appear to include grazing, hunting and residential development.

In the CIAA for Parcel 7416, there are approximately 20 wells currently producing; the closest is one mile away from the parcel. There are no wells on the parcel. In the CIAA for Parcel 7429, there is one producing well, about 8.5 miles away from the parcel. There are no wells on the parcel.

Reasonably Foreseeable Future Actions

No other NEPA actions are being considered in the CIAAs.

The 3,000-acre Brush Mountain Ranch Conservation Easement lies within the CIAA for Parcel 7429, which restricts development of private land for big game protection. This easement does not restrict oil and gas development.

The reasonably foreseeable development (RFD) scenario in the Little Snake RMP analyzed the drilling and development of 3,031 wells within the field office in the coming 20 years. This projection was based on historical oil and gas development and production activities, leasing, and economic factors. As described in 2015 Greater Sage-Grouse Resource Management Plan Amendment, new mitigation measures for sage-grouse protection approved in the RMPA could result in fewer new leases and fewer new wells, but the magnitude of these impacts is unknown (BLM 2015b).

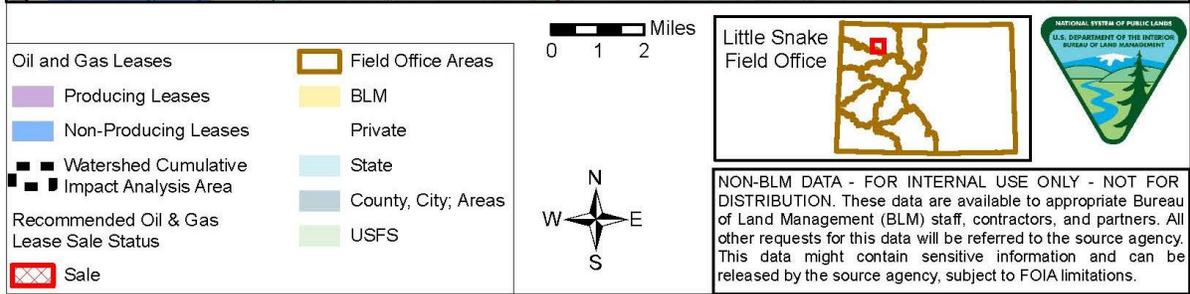
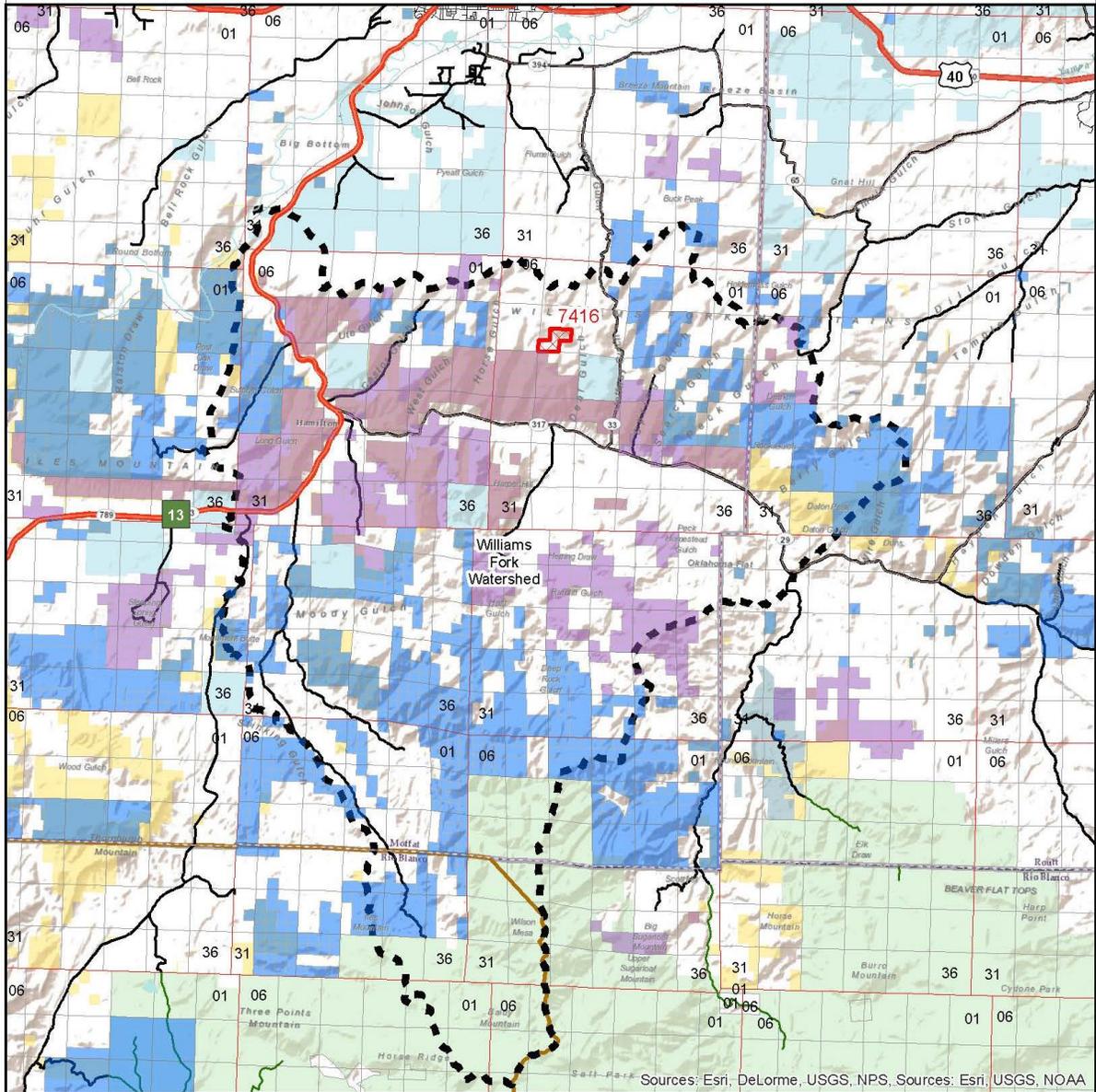


Figure 3-1. Watershed Cumulative Impact Analysis Area for Lease Parcel 7416.

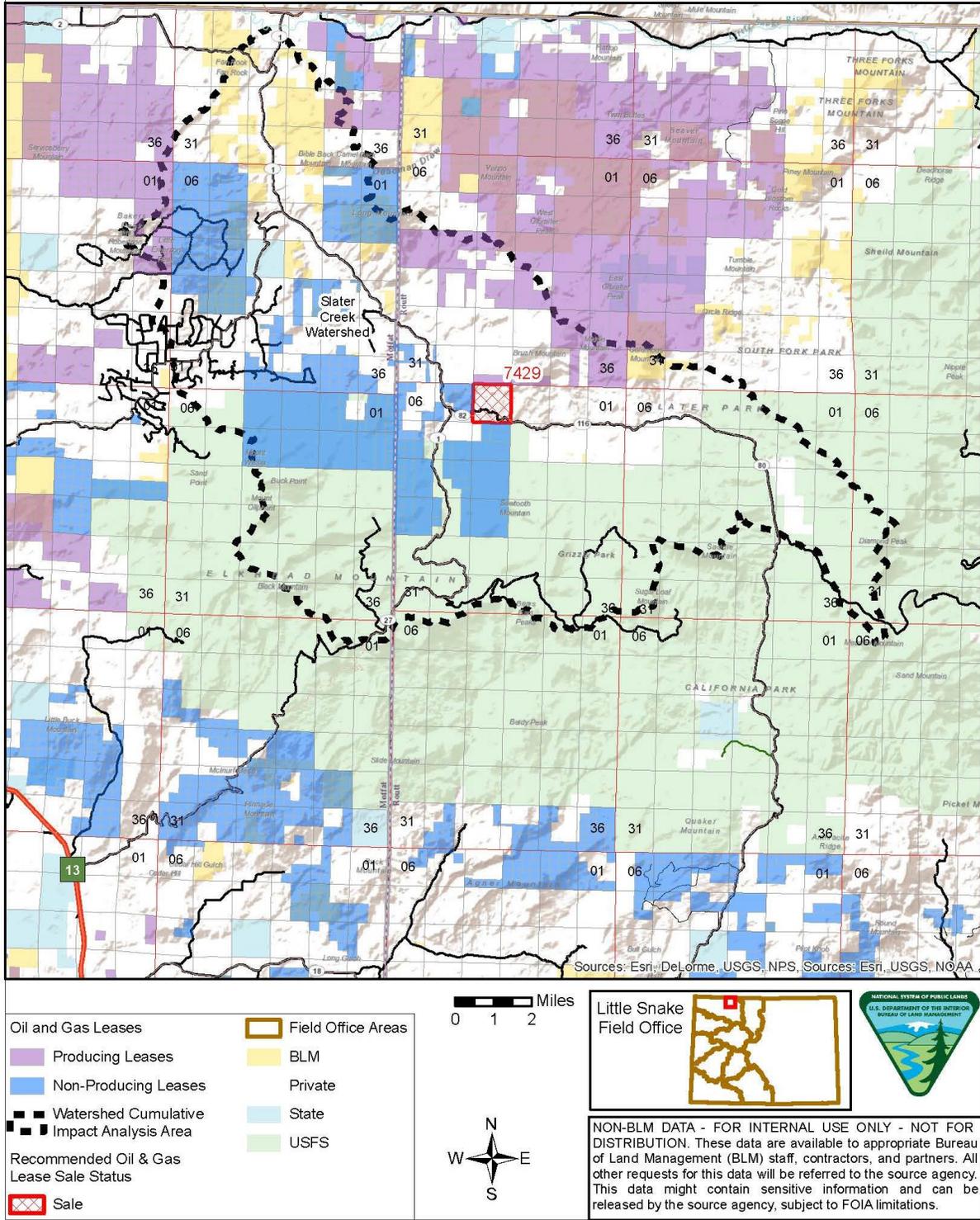


Figure 3-2. Watershed Cumulative Impact Analysis Area for Lease Parcel 7429.

3.4 ENVIRONMENTAL CONSEQUENCES OF LEASING AND POTENTIAL DEVELOPMENT

3.4.1 Physical Resources

3.4.1.1 Air Quality and Climate

Affected Environment:

Analysis indicators related to air quality can be described in terms of pollutant classes, standards, and concentrations. The overall health of any region's air quality is determined by monitoring for a pollutant and determining if the measured ground level concentration is below the applicable standard. Areas where pollutant concentrations are below the applicable are said to be in attainment with the standards, whereas areas that currently violate a standard or have violated one in the past are designated as non-attainment or maintenance areas.

Federal and State Air Quality Standards

The U.S. Environmental Protection Agency (EPA) has established NAAQS for criteria pollutants, including carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), particulate matter (PM₁₀ and PM_{2.5}), sulfur dioxide (SO₂), and lead (Pb). Exposure to air pollutant concentrations greater than the NAAQS has been shown to have a detrimental impact on human health and the environment, and thus ambient air quality standards must not be exceeded in areas where the general public has access. All of the criteria pollutants are directly emitted from a variety of source types, with the exceptions being ground level ozone, and the secondary formation of condensable particulate matter (PM_{2.5}). Ozone is chemically formed in the atmosphere via interactions of oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight and under certain meteorological conditions (NO_x and VOCs are ozone precursors). Secondary PM_{2.5} forms when certain products of combustion from a source stack cool sufficiently enough to condense to form a solid or aerosol that can then be measured via traditional monitoring methods. The majority of oil and gas related emissions that can contribute to secondary PM formation include NO_x and SO₂ (via a reaction with ammonia in the presence of water to form ammonium nitrate or ammonium sulfate) and VOCs (which can react with ozone to form organic carbon).

The CAA established two types of NAAQS:

Primary standards: – Primary standards set limits to protect public health, including the health of "sensitive" populations (such as asthmatics, children, and the elderly).

Secondary standards: – Secondary standards set limits to protect public welfare, including protection against decreased visibility, and damage to animals, crops, vegetation, and buildings.

EPA regularly reviews the NAAQS (every five years) to ensure that the latest science on health effects, risk assessment, and observable data such as hospital admissions are evaluated, and can revise any NAAQS if the data supports a revision. Table 3-1 lists the federal and any applicable Colorado ambient air quality standards.

Table 3-1: Ambient Air Quality Standards

Pollutant [final rule citation]		Standard Type	Averaging Period	Level ^a	Form
Carbon Monoxide [76 FR 54294, Aug 31, 2011]		Primary	8-hour	9 ppm	Not to be exceeded more than once per year ^c
			1-hour	35 ppm	
Lead [73 FR 66964, Nov 12, 2008]		Primary and secondary	Rolling 3-month average	0.15 µg/m ³	Not to be exceeded
Nitrogen Dioxide [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]		Primary	1-hour	100 ppb	98th percentile, averaged over 3 years
		Primary and secondary	Annual	53 ppb	Annual mean
Ozone [80 FR 65292, Oct 26, 2015]		Primary and secondary	8-hour	0.070 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particulate Matter [73 FR 3086, Jan 15, 2013]	PM _{2.5}	Primary	Annual	12 µg/m ³	Annual mean, averaged over 3 years
		Secondary	Annual	15 µg/m ³	Annual mean, averaged over 3 years
		Primary and secondary	24-hour	35 µg/m ³	98th percentile, averaged over 3 years
	PM ₁₀	Primary and secondary	24-hour	150 µg/m ³	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide [75 FR 35520, Jun 22, 2010] [38 FR 25678, Sept 14, 1973]		Primary	1-hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3-hour	0.5 ppm ^b	Not to be exceeded more than once per year

^a mg/m³ = milligrams per cubic meter, µg/m³ = micrograms per cubic meter, ppb = parts per billion, ppm = parts per million.

^b Colorado Ambient Air Quality Standard for 3-hour SO₂ is 0.267 ppm.

Source: National – 40 CFR 50, Colorado – 5 CCR 1001-14

^c 8-hr CO standard is based on the second high

EPA has delegated regulation of air quality under the federal Clean Air Act to the State of Colorado. The Colorado Department of Public Health and Environment (CDPHE), Air Pollution Control Division (APCD) administers Colorado’s air quality control programs and is responsible

for issuing permits for subject emissions sources. The State has established the Colorado Ambient Air Quality Standards (CAAQS), which can be more, but not less stringent than the NAAQS.

In addition to the criteria pollutants, regulations also exist to control the release of toxic pollutants, otherwise known as hazardous air pollutants (HAPs). HAPs are chemicals that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects. Standards do not exist for HAPs, however mass based emissions limits and risk based exposure thresholds have been established as significance criteria to require maximum achievable control technologies (MACT) for certain industrial source classes. There are currently 187 compounds or classes of compounds listed on EPA's air toxics web site that have been designated as HAPs.

The CAA and FLPMA require BLM and other federal agencies to ensure actions taken by the agency comply with applicable federal, state, tribal, and local air quality standards and regulations. FLPMA further directs the Secretary of the Interior to take any action necessary to prevent unnecessary or undue degradation of the lands [Section 302 (b)], and to manage the public lands "in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values" [Section 102 (a)(8)].

Current Conditions Surrounding Proposed Parcels

The proposed parcels being considered for this sale are within an air quality region that is in attainment with all of the NAAQS. Air quality for any region is influenced by the amount of pollutants that are released within the vicinity and up wind of that area, and can be highly dependent upon the contaminants' chemical and physical properties. Additionally, an area's topography or terrain (such as mountains and valleys) and weather (such as wind direction and speed, temperature, air turbulence, air pressure, rainfall, and cloud cover) would have a direct influence on how pollutants accumulate or disperse. Monitoring data is limited, and all pollutants are not monitored at all monitoring locations, and thus localized monitoring data relative to the proposed action area may not be available. The following monitoring and National Emissions Inventory (NEI) data tables provide a reasonable correlation of pollutant loading versus measured impacts for the LSFO for counties near the proposed lease sale.

Table 3-2. Ambient Air Quality Monitoring Data¹

County ²	Pollutant	Averaging Period	Monitored Values (ppm)		
			2012	2013	2014
Moffat	O ₃	8-hr (4 th max)	0.066	0.065	0.062
Routt	PM ₁₀	24-hr (2 nd max)	93	77	81
Rio Blanco	NO ₂	24-hr (8 th max)	19	24	14
Rio Blanco	NO ₂	Annual (1-hr mean)	2	3	2
Rio Blanco	O ₃	8-hr (4 th max)	0.069	0.091	0.062
Rio Blanco	PM _{2.5}	24-hr (8 th max)	25	16	13
Rio Blanco	PM _{2.5}	Annual (24-hr mean)	9.9	8.9	7.6
Jackson ³	O ₃	8-hr (4 th max)	0.059	0.064	0.059

¹ Ambient air quality monitoring data is from the US EPA Air Data website, statistical analysis report by county and excludes exceptional events.

² Rio Blanco and Jackson counties are outside of the LSFO boundary to the south and east, respectively.

³ Jackson County also had monitoring data for CO, NO₂, and SO₂, however, all the values were exceptionally low compared to the standards, and for the sake of brevity, they were not included.

Table 3-3. 2011 National Emissions Inventory Data¹ for Monitored Counties (tons)

County	PM ₁₀	PM _{2.5}	VOC	NO _x	CO	SO ₂	CO ₂	CH ₄	N ₂ O	HAPs
Moffat	5,263	1,352	34,530	15,864	13,442	3,989	103,302	59	3	5,555
Routt	7,849	2,128	30,562	7,765	19,279	2,243	295,613	530	6	2,040
Rio Blanco	5,393	1,162	51,648	5,679	11,177	445	68,630	20	2	4,563
Jackson	2,347	1,648	20,556	547	20,865	126	214,196	0	551	1,649

¹ The GHG emissions (CO₂, CH₄, N₂O) from the NEI only include mobile and fire related sources.

The Prevention of Significant Deterioration (PSD) provisions of the CAA established an additional air quality classification system designed to protect sensitive resources, and include Class I areas in which very little degradation of air quality is allowed (e.g., national parks and large wilderness areas) and Class II areas (all non-Class I areas). The PSD Class II designation allows for moderate degradation of air quality within certain limits above baseline air quality. PSD increments, or the amount of air pollution an area is allowed to increase beyond the relative baseline limit that was set for the area when the first PSD permit application was approved, prevents the air quality in clean (i.e., attainment) areas from deteriorating to the level set by the NAAQS. Although the PSD rule only applies to major stationary sources of air pollution as defined in the CAA, an increment analysis can provide a useful measure by which to evaluate (for informational purposes) the possible impact on regional air quality from potential new sources of pollution. PSD increment analyses for major source permitting purposes are the responsibility of the APCD.

In addition to the criteria pollutant PSD increments, Class I & II areas may also be analyzed for Air Quality Related Values (AQRVs). AQRVs are metrics for atmospheric phenomenon like visibility and deposition impacts that may adversely affect specific scenic, cultural, biological, physical, ecological, or recreational resources.

Visibility impairment or haze is caused when sunlight encounters tiny pollution particles in the atmosphere, and is either absorbed or scattered which reduces the clarity and color of what can be seen. Visibility can be expressed in terms of deciviews (dv) or standard visual range (SVR). A change of one dv is approximately a 10% change in the light extinction coefficient (i.e., light that is scattered or absorbed and does not reach the observer), which is a small, but usually perceptible scenic change. Class I areas are required to provide for natural visibility conditions that reflect a pristine environment without observable pollution effects. The ability of a pollutant to cause various degrees of visibility impacts is primarily a function of its physical size, and chemical composition and properties. Various visibility impacting pollutant species have been monitored via the Interagency Monitoring of Protected Visual Environments (IMPROVE) network in many of the sensitive Class I areas around the country since the 1980s. The federal land managers use a data analysis threshold (DAT) of 0.5 dv for projects that contribute to a visibility problem and a value of 1.0 dv for projects that cause visibility issues. See Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I Report—Revised (2010).

The nominated parcels being analyzed for the May 2016 sale are located in a Class II area. The closest Class I areas to the parcels are the Flat Tops Wilderness which lies approximately 36 kilometers to the south of parcel 7416, and the Mt. Zirkel Wilderness which lies approximately 37 kilometers to the east of parcel 7429 (Figure 3-3). Additionally, the Dinosaur National Monument (a sensitive Class II resource, that has been provided Class I protection for sulfur deposition by the State of Colorado) is approximately 78 kilometers to the west of the closest parcel (7429).

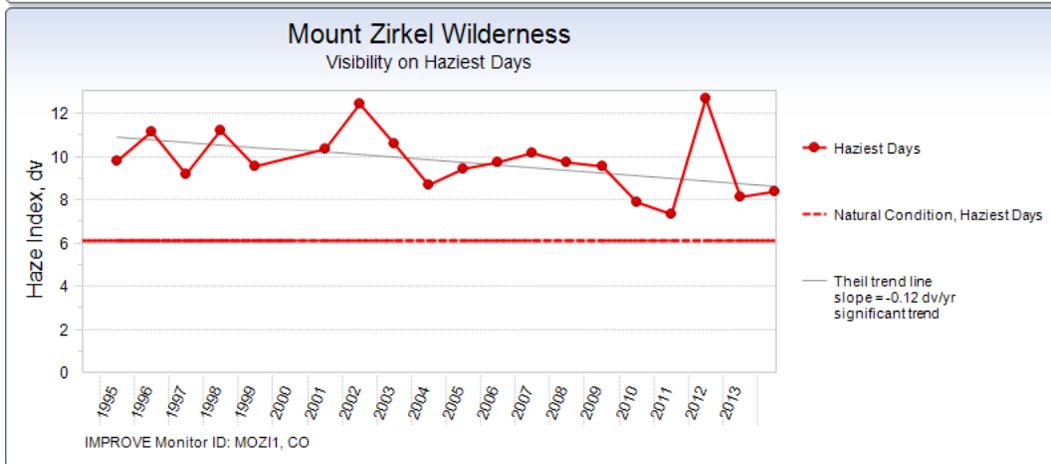
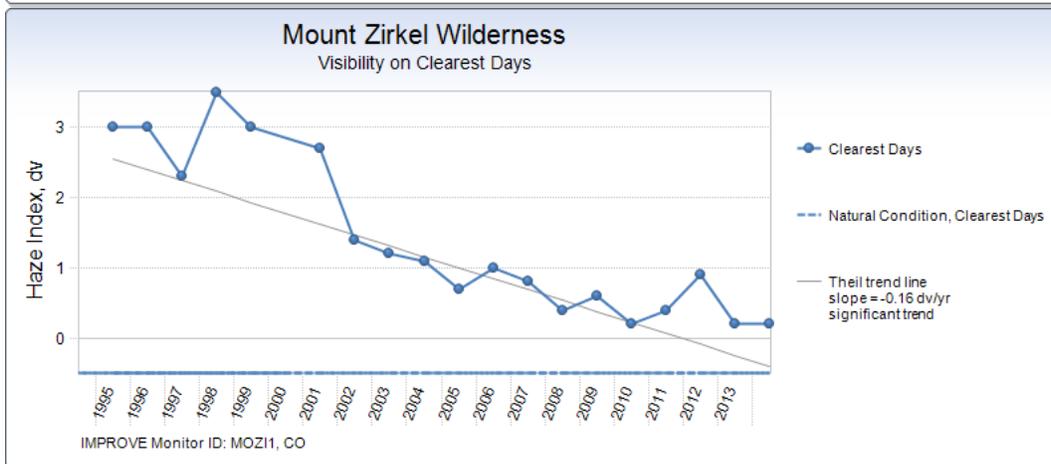
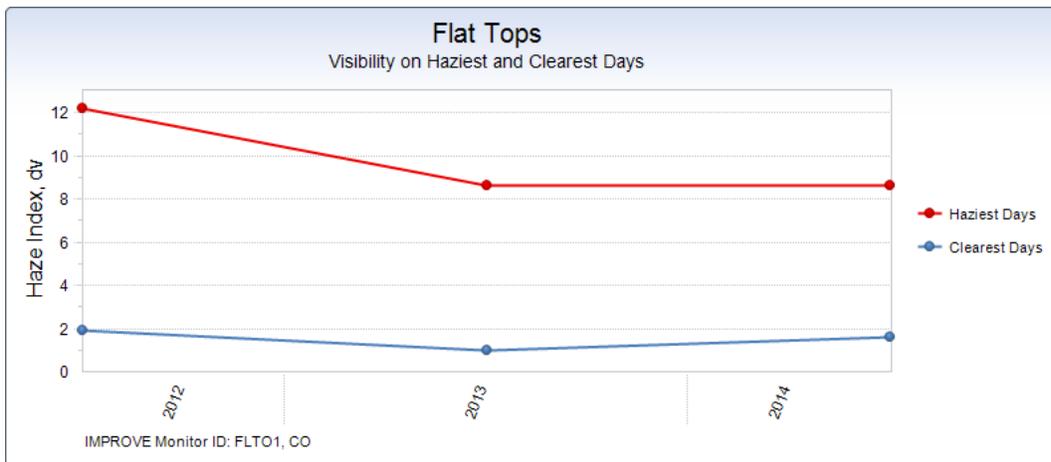


Figure 3-3. Class I Area Visibility Trends

Deposition. Deposition is the process by which pollutants are removed from the atmosphere via mechanical and chemical processes. When air pollutants such as sulfur and nitrogen are deposited into ecosystems, they may cause acidification, or enrichment of soils and surface waters. Atmospheric nitrogen and sulfur deposition may affect water chemistry, resulting in impacts to aquatic vegetation, invertebrate communities, amphibians, and fish. Deposition can

also cause chemical changes in soils that alter soil microorganisms, plants, and trees. Although nitrogen is an essential plant nutrient, excess nitrogen from atmospheric deposition can stress ecosystems by favoring some plant species and inhibiting the growth of others. These processes are measured via two distinct methodologies, i.e., wet and dry deposition monitors. The National Atmospheric Deposition Program (NADP) is a conglomerate of various wet chemistry monitoring networks designed to measure wet atmospheric deposition and study its effects on the environment. The network currently operates approximately 250 sites, many since the early 1980's. The Clean Air Status and Trends Network (CASTNET) is a national air quality monitoring network designed to provide data to assess trends in air quality, dry atmospheric deposition, and ecological effects due to changes in air pollutant emissions. CASTNET began collecting data in 1991 with the incorporation of 50 sites from the National Dry Deposition Network. CASTNET provides long-term monitoring of air quality in rural areas to determine trends in regional atmospheric nitrogen, sulfur, and ozone concentrations and deposition fluxes of sulfur and nitrogen pollutants. The federal land managers use a data analysis threshold (DAT) of 0.005 kg/hr-yr for nitrogen and sulfur deposition for determining the significance of any given project¹.

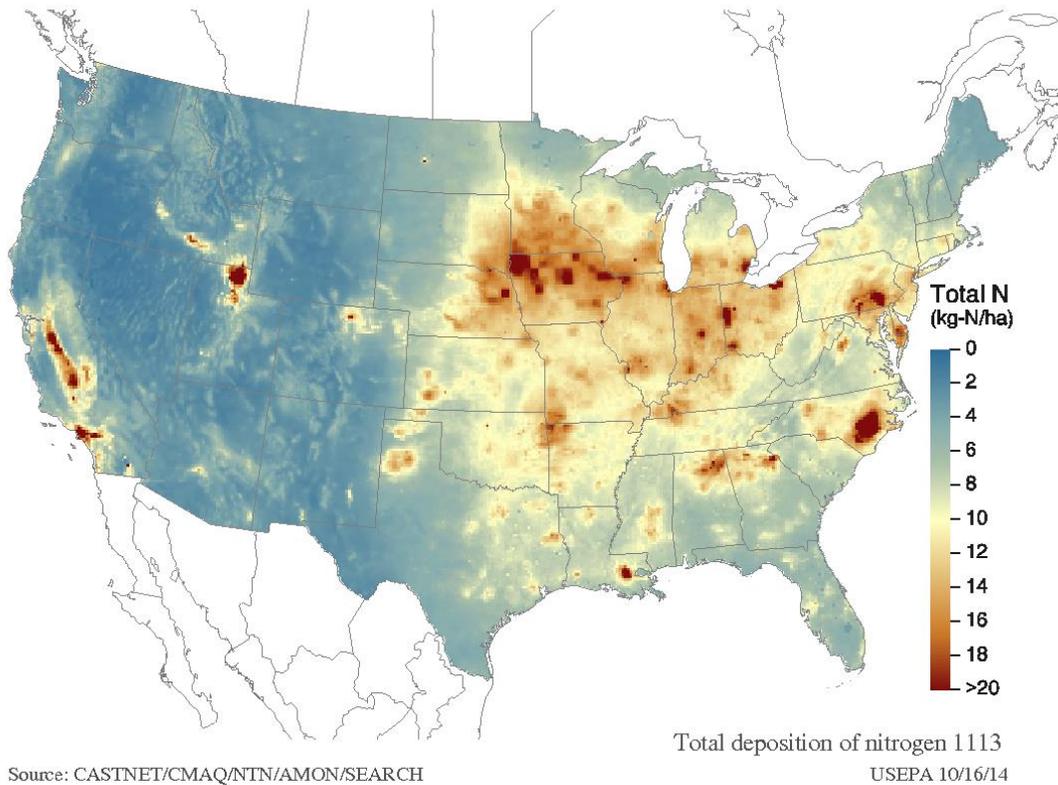


Figure 3-4. Total Nitrogen Deposition Map (2011-2013)¹

¹ The total 3 year cumulative sulfur deposition map was not included since rates approached 0 for the majority of Colorado.

Climate Change and Greenhouse Gases.

There is broad scientific consensus that humans are changing the chemical composition of Earth's atmosphere. Activities such as fossil fuel combustion, deforestation, and other changes in land use are resulting in the accumulation of trace greenhouse gases (GHGs) such as carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and several industrial gases in the Earth's atmosphere. An increase in GHG emissions is said to result in an increase in the earth's average surface temperature, primarily by trapping and thus decreasing the amount of heat energy radiated by the Earth back into space. The phenomenon is commonly referred to as global warming. Global warming is expected in turn, to affect weather patterns, average sea level, ocean acidification, chemical reaction rates, and precipitation rates, which is collectively referred to as climate change. The Intergovernmental Panel on Climate Change (IPCC) has predicted that the average global temperature rise between 1990 and 2100 could be as great as 5.8°C (10.4°F), which could have massive deleterious impacts on the natural and human environments. Although GHG levels have varied for millennia (along with corresponding variations in climatic conditions), industrialization and the burning of fossil carbon fuel sources have caused GHG concentrations to increase measurably, from approximately 280 ppm in 1750 to 400 ppm in 2014 (as of April). The rate of change has also been increasing as more industrialization and population growth is occurring around the globe. This fact is demonstrated by data from the Mauna Loa CO₂ monitor in Hawaii that documents atmospheric concentrations of CO₂ going back to 1960, at which point the average annual CO₂ concentration was recorded at approximately 317 ppm. The record shows that approximately 70% of the increases in atmospheric CO₂ concentration since pre-industrial times occurred within the last 54 years.

Environmental Consequences of Leasing and Development (Direct and Indirect Impacts):

The decision to offer the identified parcels for lease would not result in any direct emissions of air pollutants. However, any future development of these leases would result in emissions of criteria, HAP, and GHG pollutants. Subsequent development of any leases sold would result in both short and longer term emissions of pollutants, including GHGs. Developmental air impacts would be addressed in a subsequent analysis when lessees file an Application for Permit to Drill (APD). The analysis would determine if any contemporaneous incremental increases from project emissions cause significant impacts at the local and regional scales. All proposed activities including, but not limited to, exploratory drilling activities would be subject to applicable local, State, and Federal air quality laws and regulations.

Any subsequent activity authorized after APD approval could include soil disturbances resulting from the construction of well pads, access roads, pipelines, power lines, and drilling. Any disturbance is expected to cause increases in fugitive dust and potentially inhalable particulate matter (specifically PM₁₀ and PM_{2.5}) in the project area and immediate vicinity. Particulate matter, mainly dust, may become airborne when drill rigs and other vehicles travel on dirt roads to drilling locations. Air quality may also be affected by exhaust emissions from engines used for drilling, transportation, gas processing, compression for transport in pipelines, and other uses.

These sources would contribute to potential short and longer term increases in the following criteria pollutants: carbon monoxide, ozone (a secondary pollutant, formed via photochemical reactions between VOC and NO_x emissions), nitrogen dioxide, and sulfur dioxide. Non-criteria pollutants (for which no national standards have been set) such as carbon dioxide, methane and

nitrous oxide (GHGs), air toxics (e.g., benzene), and total suspended particulates (TSP), as well as impacts to visibility and atmospheric deposition.

During exploration and development, ‘natural gas’ may at times be flared and/or vented (for safety) from conventional, coal bed methane, and shale wells (depending on the resources present on the lease). The gas is likely to contain volatile organic compounds that could also be emitted from reserve pits, produced water disposal facilities, and/or tanks located at the site. The development stage may likely include the installation of pipelines for transportation of raw product. New centralized collection, distribution and/or gas processing facilities may also be necessary.

Research has identified the general potential impacts of anthropogenic GHG emissions and their effects on global climatic conditions. Anthropogenic GHGs differentially absorb and emit thermal radiation in the atmosphere and therefore may contribute incrementally to climate change. Changes in global temperatures and climate vary significantly with time, and are subject to a wide range of driving factors and complex interrelationships. Research on climate change impacts is an emerging and rapidly evolving area of science, but given the lack of adequate analysis methods it is not possible to identify specific local, regional, or global climate change impacts based on potential GHG emissions from any specific project’s incremental contributions to the global GHG burden. In the coming decades climate change may lead to changes in the Mountain West and Great Plains, such as increased drought and wild land fire potential. BLM would continue to evaluate the impacts of oil and gas exploration and development on the global climate as the science and tools for providing appropriate analysis evolve, and apply appropriate adaptive management techniques and BMPs to address changing conditions.

At a minimum, operators must construct at least one producing well (unless the parcel is included in a unit as some point in the future) in order to continue to hold the lease beyond the 10 year primary lease term. With that in mind, BLM has developed an estimated average per well emissions inventory based on current resource recovery methods and our knowledge of development for areas similar to those parcels that have been nominated for lease. The emissions inventory is only useful for estimating the minimum indirect impacts of leasing the nominated parcels. Since it is unknown if the parcels would be explored and/or developed, or the extent of any subsequent exploration and development on either a temporal or spatial scale, it is not possible to reasonably assess air quality impacts through dispersion modeling or another acceptable method at this time. However, BLM would request or develop an exploration / development emissions inventory with project-specific information at the time that BLM receives a development proposal and performs a site-specific NEPA analysis.

Table 3-4. Typical per Well Emissions (maximum year - tons)

Phase	PM ₁₀	PM _{2.5}	VOC	NO _x	CO	SO ₂	CO ₂	CH ₄	N ₂ O	HAPs
Construction	6.88	0.55	0.79	15.24	3.44	0.0003	2161.53	1.12	0.05	0.03
Production	0.04	0.23	2.62	0.39	0.36	0.0001	390.55	11.09	0.0008	0.21
Totals	6.93	0.78	3.40	15.63	3.80	0.0004	2552.08	12.21	0.0526	0.24

BLM assesses project-specific impacts on air resources at the development plan or permitting stage. Much more detailed information will be available at that stage to allow BLM to more accurately estimate emissions and determine potential impacts to air quality. Substantial emission-generating activities cannot occur without further BLM analysis and approval of proposals for exploration and development operations. BLM Instructional Memorandum CO-2015-009 provides detailed direction and methods for future project level analysis. Based on the outcome of our future analysis, BLM would make its approval of development activities subject to COA that would address air pollutant impacts and climate change pollutants as appropriate.

Environmental Consequences of Leasing and Potential Development (Cumulative Impacts):

This lease sale, when combined with the past, present, and reasonably foreseeable future actions may, through future development, contribute incrementally to the deterioration of air quality in the region. At present, any future potential cumulative impact is too speculative to provide precise information for the decision-maker, given that the pace, place, and specific equipment configurations of such development are unknown. Development of fluid minerals on these leases would result in additional surface disturbance and emissions during drilling, completion, and production activities. The severity of these incremental impacts could be elevated based on the amount of contemporaneous development (either federal or private) in surrounding areas. Notwithstanding the uncertainties described above, BLM has used mapping and a modeling study to estimate the potential cumulative impacts to air quality from leasing and development of the parcels under consideration in light of ongoing oil and gas exploration and development in the area.

To examine potential cumulative air quality impacts from activities that it authorizes, BLM has initiated the Colorado Air Resources Management Modeling Study (CARMMS). The study includes assessment of statewide impacts of projected oil and gas development (both federal and fee (i.e., private)) out to year 2021 for three development scenarios (low, medium, and high). Projections for development are based on either the most recent FO Reasonably Foreseeable Development (RFD) document (high), or a projection of the current 5 year average development pace forward to 2021 (low). The medium scenario includes the same well count projections as the high scenario, but assumes restricted emissions, whereas the high assumes current development practices and existing emissions controls required by regulations (2012). Each FO was modeled with the source apportionment (SA) option, meaning that incremental impacts to regional ozone and AQRVs from development in these areas within each field office are essentially tracked to better understand the significance of such development on impacted resources and populations. The CARMMS project leverages the work completed by the WestJumpAQMS, and the base model platform and model performance metrics are based on those products (2008). The complete report and associated data is available on our website at http://www.blm.gov/co/st/en/BLM_Information/nepa/air_quality.html.

BLM continually tracks authorized oil and gas activity to determine which CARMMS scenario would be most appropriate to estimate air resource impacts correlations based on the source apportionment area's (i.e. field office) cumulative federal development and total production (Table 3-5). Although the predicted impacts are based on future modeling results (2021), the differences in the impacts between the scenarios and the base year provide insight into how mass

emissions would impact the atmosphere on a relative basis, and are thus useful for making qualitative comparisons with emissions levels at the current pace of development.

Table 3-5. Current Tracking Data (2014 COGCC & AFMSS Data)

LSFO Counties	Oil Production (bbl)	Gas Production (Mcf)	No. of producing Wells	New LSFO Federal wells Since 2011	New LSFO Non-Federal wells Since 2011
Moffat & Routt	464,414	16,446,360	812	14	78

Thus, the CARMMS data provide a reasonable projection of potential impacts that could occur if oil and gas development continues at the current tracked pace, or at a higher pace.

Considering that the CARMMS scenarios are based on aggressive oil and gas development projections that current development levels do not approach, we assume that emissions associated with any potential oil and gas developed through year 2021 on the nominated lease parcels is entirely accounted for in the CARMMS projected 2021 emissions inventories (as modeled). Although the current cumulative annual average is approximately 26 wells per year, the trend has been negative since 2012 and is closer to the low scenario, which assumed 20 wells per year, than the high, which assumed 138 wells per year (78 federal and 60 non-federal). As compared with the low scenario which estimated 11 federal wells per year, the current average is 3 federal wells per year in the LSFO. We therefore present the Low CARMMS scenario data below to describe potential impacts from cumulative development in the LSFO. Table 3-6 shows potential emissions from construction and production for the 2021 new O&G wells associated with the LSFO SA Low scenario estimates.

Table 3-6. LSFO SA Area O&G Emissions (tons per year) — CARMMS Low Scenario

LSFO	Year	PM ₁₀	PM _{2.5}	VOC	NO _x	CO	SO ₂	CO ₂	CH ₄	N ₂ O
Baseline Federal	2011	140	36	1,523	741	591	6	256,442	7,621	5
Future Federal	2021	141	37	1,003	592	522	3	261,378	8,527	5
Baseline Non-Federal	2011	74	15	435	189	221	1	66,338	3,075	1
Future Non-Federal	2021	91	23	556	389	377	2	138,610	4,524	2

To provide an estimate for the range of potential downstream (indirect combustion) CO₂ emissions for the production associated with a single well up to the LSFO cumulative (total production through 2021) CARMMS Low scenario, BLM derived the production potentials from the various sources of information that fed into the CARMMS emissions inventory data. The

data included analysis of production trends identified in the Colorado Oil and Gas Conservation Commission (COGCC), IHS Inc., and AFMSS databases, operator surveys from the recent BLM CO Northwest District RMP efforts and information from BLM staff and previous air quality studies such as WestJump. The production estimates are cumulative over the CARMMS study timeframe (i.e., 2011 – 2021) for new wells only, and account for the estimated production decline expected from new wells on an annualized basis over the same period. The CO₂ emissions estimates are based on the emissions factors published by the Energy Information Administration (CO₂ Coefficients, Feb 14, 2013 - https://www.eia.gov/environment/emissions/co2_vol_mass.cfm). For gas we used the industrial flared gas factor to account for the expected higher BTU values normally seen in unprocessed gas (prior to the removal of more value components). For oil we selected the residual heating fuel factor to conservatively account for the heavier hydrocarbons found in crude prior to processing. The calculations assume combustion of 100% of the product without refinement/processing, or accounting for potential losses and uses as something other than a fuel stock (i.e. petroleum based products).

The data are presented on a single well and cumulative basis in Table 3-7 below. While not representative of any single actual well, formation (there are 47 different formations in the LSFO alone) or parcel potential, the data provide a broad-scale estimate of potential downstream CO₂ emissions for the potential range of future development (i.e. bookends), with the obvious exception of a dry well.

Table 3-7. Indirect CO₂ Emissions from Estimated Cumulative Production Combustion

CARMMS Scenario	Estimated Produced Gas (Mcf)	Estimated Produced Oil (bbl)	Gas EF (lbs/Mcf)	Oil EF (lbs/gal)	CO ₂ (tons)
Low	437,388	2,394	128.4	26	57,406
Cumulative	46,363,173	253,719			3,108,450

The PSD comparison data below are not a PSD increment analysis, which applies only to major sources and is the responsibility of CDPHE. Further, the cumulative source groups do not represent PSD permit applications where such an analysis would be conducted. The data are presented for informational purposes only. Larger cumulative source groups are expected to exceed the increments used to evaluate individual sources requiring a PSD increment consumption analysis for permitting. The source apportionment impact groups shown below are as follows, A = LSFO federal oil and gas, R = Colorado Federal oil and gas, and S = Colorado cumulative (federal and non-federal) oil and gas (Note: Source group R and S also include federal mining activities).

Table 3-8. CARMMS Low Scenario – Maximum PSD Concentrations (µg/m3) & Increments (%)

Source Group	PSD Class I Increment	Max @ any Class I area	% of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	% of PSD Class II Increment	Class II Area where Max occurred
NO₂ Annual								
A	2.5	0.003	0.1%	Mount Zirkel	25	0.004	0.0%	Dinosaur
R		0.239	9.6%	Mesa Verde		0.238	1.0%	South San Juan
S		2.85	114.0%	Mesa Verde		2.5	10.0%	South San Juan
PM₁₀ 24-hour								
A	8	0.005	0.1%	Mount Zirkel	30	0.006	0.0%	Dinosaur
R		0.808	10.1%	Flat Tops		1.114	3.7%	Raggeds
S		1.788	22.3%	Mesa Verde		1.438	4.9%	South San Juan
PM₁₀ Annual								
A	4	0.001	0.0%	Mount Zirkel	17	0.001	0.0%	Dinosaur
R		0.169	4.2%	Mount Zirkel		0.183	1.1%	Raggeds
S		0.688	17.2%	Mesa Verde		0.672	4.0%	South San Juan
PM_{2.5} 24-hour								
A	2	0.004	0.2%	Mount Zirkel	9	0.005	0.1%	Dinosaur
R		0.804	40.2%	Flat Tops		1.094	12.2%	Raggeds
S		0.834	41.5%	Flat Tops		1.110	12.3%	Raggeds
PM_{2.5} Annual								
A	1	0.0	0.0%	Mount Zirkel	4	0.0	0.0%	Dinosaur
R		0.167	16.7%	Mount Zirkel		0.175	4.4%	Raggeds
S		0.173	17.3%	Mount Zirkel		0.185	4.6%	Raggeds
SO₂ 3-hour								
A	25	0.001	0.0%	Dinosaur	512	0.001	0.0%	Dinosaur
R		0.189	0.8%	Dinosaur		0.189	0.0%	Dinosaur
S		0.240	1.0%	Dinosaur		0.240	0.0%	Dinosaur

Source Group	PSD Class I Increment	Max @ any Class I area	% of PSD Class I Increment	Class I Area where Max occurred	PSD Class II Increment	Max @ any Class II area	% of PSD Class II Increment	Class II Area where Max occurred
SO₂ 24-hour								
A	5	0.0	0.0%	Dinosaur	91	0.0	0.0%	Dinosaur
R		0.135	0.067%	Dinosaur		0.135	0.067%	Dinosaur
S		0.154	0.085%	Dinosaur		0.154	0.085%	Dinosaur
SO₂ Annual								
A	2	0.0	0.0%	Dinosaur	20	0.0	0.0%	Dinosaur
R		0.014	0.7%	Dinosaur		0.014	0.7%	Dinosaur
S		0.018	0.9%	Dinosaur		0.018	0.9%	Dinosaur

As shown above, the cumulative development in the LSFO is well below 1% of the increment value (the significance threshold used by CDPHE for PSD source increment consumption).

The CARMMS visibility impact analysis predicted no days of visibility impairment above the FLAG thresholds (0.5dv and 1.0dv) for any Class I or Class II area analyzed (even though the thresholds themselves do not apply to cumulative development) as a result of LSFO federal oil and gas development. As shown below the maximum visibility impact from all projected LSFO federal oil and gas development was 0.0338dv at the Mt. Zirkel Wilderness—less than 10% of the “contributes to visibility impacts” threshold of 0.5dv. Table 3-9 provides the visibility impacts from the CARMMS low scenario for the LSFO and source groups R and S. The results also compare the visibility impacts to the twenty percent best (B20%) and worst (W20%) visibility days at the highest impacted Class I area (relative to the lease sale EA analysis area), as well as to the baseline conditions (year 2008) to show how visibility is expected to improve in 2021 (i.e., visibility impacts decrease).

Table 3-9. SA Visibility

SA Area / Group	Most Impacted Class I Area	Max Δ dv	Max Δ dv B20	Max Δ dv W20	B20% Baseline	W20% Baseline	B20% 2021	W20% 2021
A	Mt. Zirkel	0.0338	0.0003	0.0338	NA	NA	NA	NA
R		1.063	0.112	0.406	0.95	9.36	0.79	8.49
S		1.073	0.132	0.453				

Figure 3-5 contains a summary of the LSFO’s contribution (ppb) to modeled ozone exceedances within the CARMMS 4km domain. The maximum contributions to 4th high daily maximum 8-hour concentrations are expected to be minimal with respect to the 75 ppb 8-hour ozone standard, and the maximum contributions to any modeled exceedance (above NAAQS) are expected to be much less than 1% of the current ozone standard. Figure 3-6 (left) shows the LSFO’s maximum ozone contribution overall (not an exceedance) within the CARMMS domain. In general future year ozone design value projections (substituting 2021 for three consecutive years of modeling results) indicates that ozone levels drop in 2021 relative to the baseline conditions. The difference plot below (Figure 3-6 right) shows the largest ozone reduction in the northern front range region, while there are slight ozone increases in the northwestern part of the state, and the southern front range region. BLM does not have the incremental analysis to describe the LSFO SA contributes to the new 70ppb ozone standard. This data is currently be pulled from the CARMMS modeling data. Regardless, the incremental contributions are not expected to be significantly different from the contributions to the 75ppb standard (estimated to be not more than 7% as compared to the change in the standard).

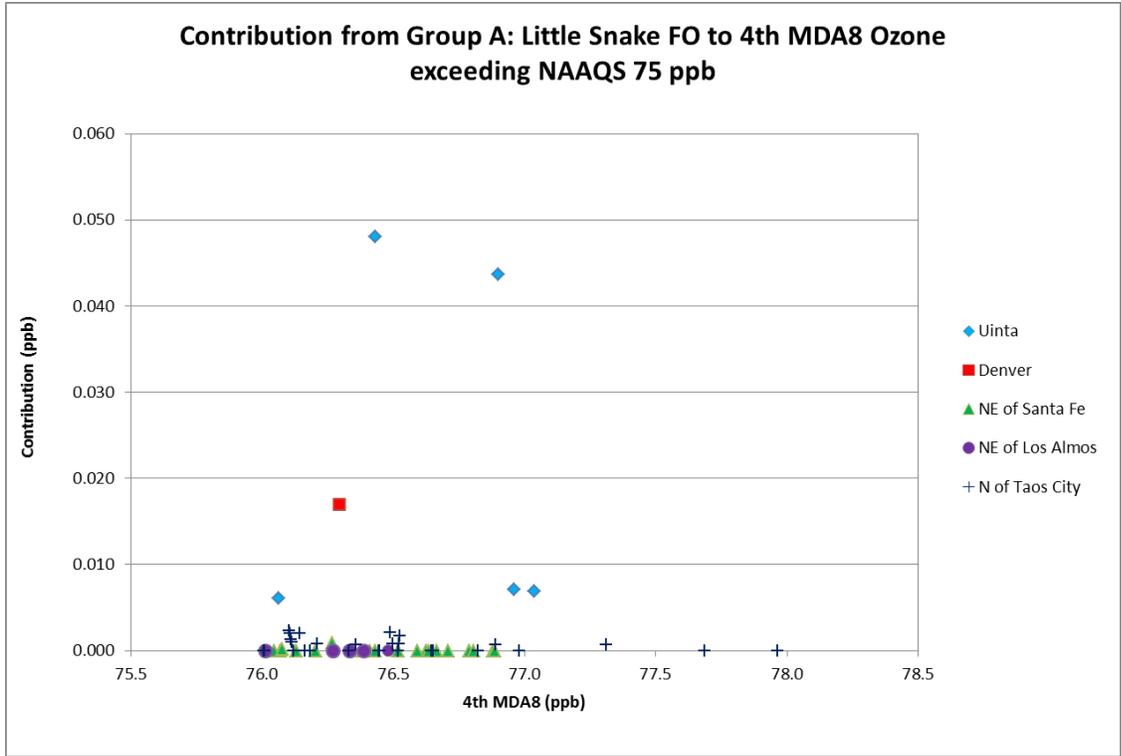


Figure 3-5. LSFO SA Area Exceedance Contributions at Monitored Location

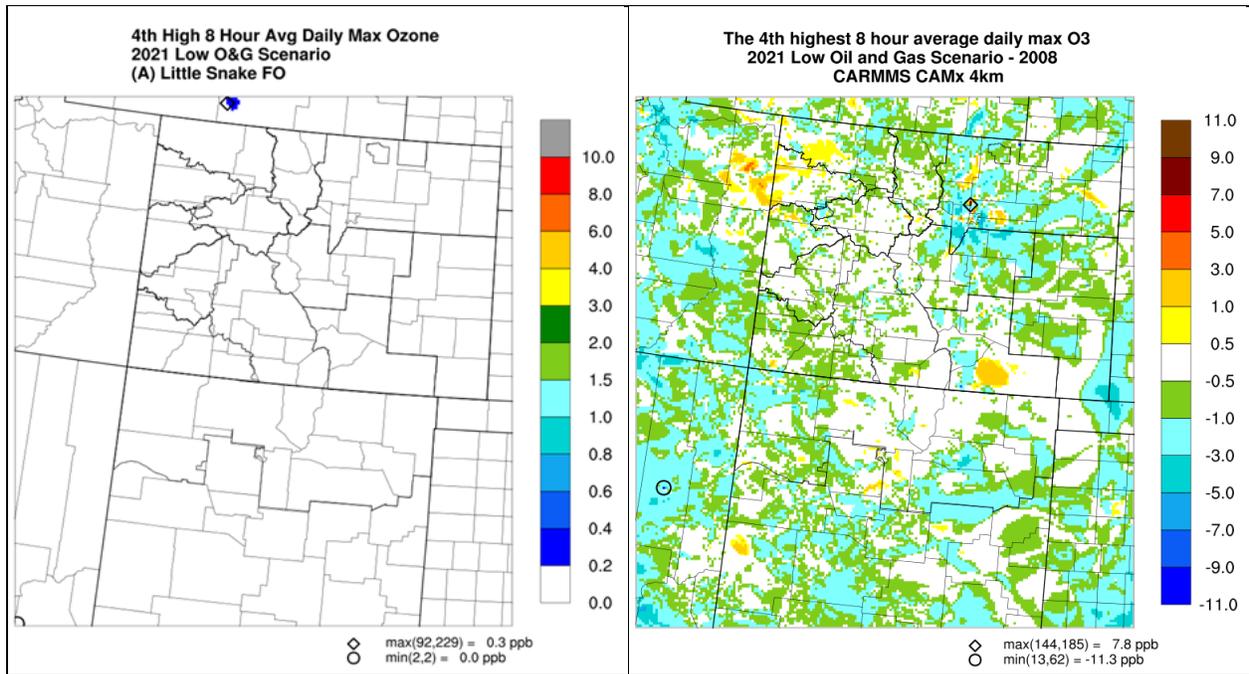


Figure 3-6. LSFO Maximum Ozone Contribution and CARMMS Difference Plot (2021-2008)

Figure 3-7 below contains future year difference plots for the other pollutants of concern within the CARMMS domain. In general, the PM increases and NOx decreases are heavily associated with the urban areas along the front range corridor.

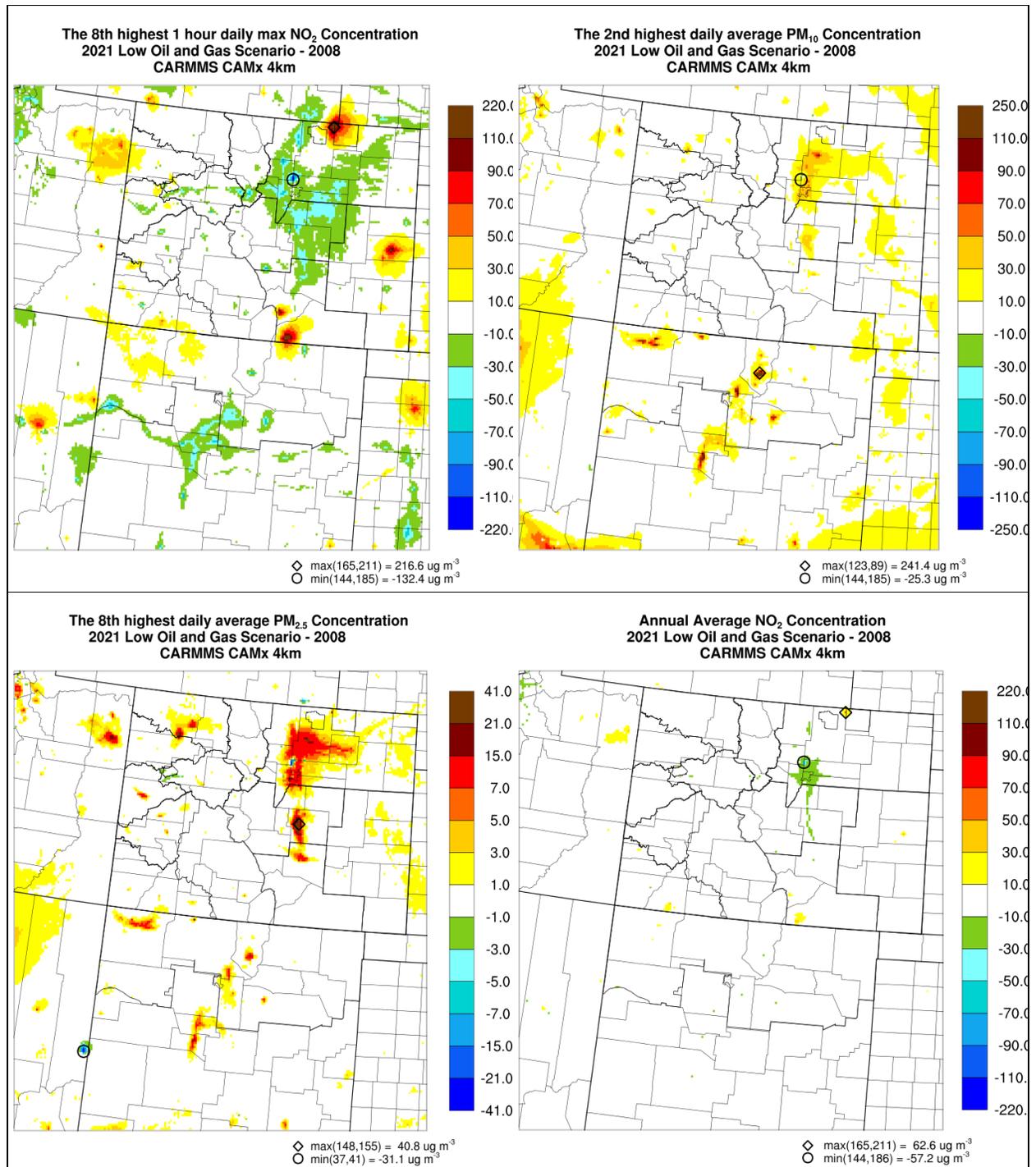


Figure 3-7. Future Year CARMMS Differences for Selected Pollutants of Concern

As future oil and gas development occurs in the LSFO, BLM Colorado will add project-specific emissions (based on approved APDs) to total regional emissions estimates to compare the LSFO oil and gas and other regional emissions rates modeled in cumulative air quality modeling studies (CARMMS) along with the corresponding modeling results to confirm whether the modeled emissions predicted in the cumulative impacts analysis accurately describe the actual emissions from activities approved by BLM Colorado, and whether any refinement of the model is needed.

Table 3-10 provides the SA area impacts from deposition for the highest impacted Class I area relative to the EA analysis area. Even though the LSFO is not a project in the strictest sense of the FLAG guidance, the maximum predicted nitrogen deposition is still below the project based threshold of 0.005 kg/ha-yr. With respect to the cumulative deposition impacts, CARMMS predicts federal deposition that is slightly more than 10% of the Federal Land Manager (NPS, 2015) guidance value (nitrogen critical load in Colorado Class I areas) of 2.3 kg/ha-yr. For a project, the Acid Neutralizing Capacity (ANC) Level of Acceptable Change (LAC) threshold is no change greater than 10% for lakes with base ANC > 25 µeq/l and no change greater than 1 µeq/l for lakes with base ANC values < 25 µeq/l. The ANC calculations due to nitrogen and sulfur deposition from the LSFO SA area as well as from source groups R and S are all predicted to be below the USFS ANC LAC threshold at all sensitive lakes within the CARMMS domain.

Table 3-10. SA Deposition Impacts

SA Area / Group	Most Impacted Class I Area	Nitrogen Dep. (kg/ha-yr)	Sulfur Dep. (kg/ha-yr)	Max Nitrogen Dep Baseline	Max Sulfur Dep Baseline	Max Nitrogen Dep 2021	Max Sulfur Dep 2021
A	Mt. Zirkel	0.0023	0.0000	NA	NA	NA	NA
R		0.0329	0.0250	5.13	2.34	4.1	1.47
S		0.0753	0.0258				

Cumulatively, GHG emissions from the LSFO SA area and from oil and gas development in Colorado would continue to be emitted at rates influenced by economic factors, including energy demand, commodity price, and local play development costs. BLM cannot predict the future operation of these factors across the regional or global economies, and the modeling results therefore are uncertain. CARMMS estimated future year 2021 GHG emissions (see Table 3-11 below). These totals do not account for the ultimate use or consumption of any produced minerals (see discussion and estimates above). Additionally, it should be noted that production values (estimated for CARMMS) could vary significantly over the life of any future development, making the CARMMS predictions of the potential GHG emitted in 2021 highly speculative.

Table 3-11. CARMMS GHG Estimates (Direct emissions from projected development)

SA Area / Group	CO ₂	CH ₄	N ₂ O	CO ₂ e
A	261,378	8,527	5	476,103
R	2,932,812	83,411	48	5,032,967
S	10,703,805	377,142	168	20,184,435

The CDPHE used the EPA’s State Inventory Tool to estimate future years GHG emissions inventories for Colorado. In year 2020, it is estimated that Colorado’s annual GHG emissions would be approximately 126,060,000 metric tons CO₂e. The 2021 CARMMS emissions (“S”) represent about 16% of the state of Colorado’s year 2020 CO₂e emissions. The CO₂e emissions associated with the development of the LSFO SA federal wells is 3.8% of the state’s total projected 2020 emissions.

To provide additional context, the EPA has recently modeled global climate change impacts from a model source emitting 20% more GHGs than a 1500MW coal-fired steam electric generating plant (approx. 14,132,586 metric tons per year of CO₂, 273.6 metric tons per year of nitrous oxide, and 136.8 metric tons per year of methane). It estimated a hypothetical maximum mean global temperature value increase resulting from such a project. The results ranged from 0.00022 and 0.00035 degrees Celsius occurring approximately 50 years after the facility begins operation. The modeled changes are extremely small, and any downsizing of these results from the global scale would produce greater uncertainty in the predictions. The EPA concluded that even assuming such an increase in temperature could be downscaled to a particular location, it "would be too small to physically measure or detect”, see Letter from Robert J. Meyers, Principal Deputy Assistant Administrator, Office of Air and Radiation re: “Endangered Species Act and GHG Emitting Activities (Oct. 3, 2008). The projected CARMMS emissions are a fraction of the EPAs modeled source and are shorter in duration, and therefore we conclude that any future oil and gas development on the parcels or cumulatively within the field office would have no measurable impact on the climate, although emissions will add incrementally to the global GHG loading burden.

With respect to global GHG emissions, the following predictions were identified by the EPA for the Mountain West and Great Plains region:

- The region will experience warmer temperatures with less snowfall.
- Temperatures are expected to increase more in winter than in summer, more at night than in the day, and more in the mountains than at lower elevations.
- Earlier snowmelt means that peak stream flow will be earlier, weeks before the peak needs of ranchers, farmers, recreationalist, and others. In late summer, rivers, lakes, and reservoirs will be drier.
- More frequent, more severe, and possibly longer-lasting droughts will occur.
- Crop and livestock production patterns could shift northward; less soil moisture due to increased evaporation may increase irrigation needs.
- Drier conditions will reduce the range and health of ponderosa and lodge pole pine forests, and increase the susceptibility to fire.
- Grasslands and rangelands could expand into previously forested areas.

- Ecosystems will be stressed and wildlife such as the mountain lion, black bear, long-nose sucker, marten, and bald eagle could be further stressed.

If these predictions are realized as mounting evidence suggests is already occurring, there could be impacts to other resources within the region. For example, if global climate change results in a warmer and drier climate, increased particulate matter impacts could occur due to increased windblown dust from drier and less stable soils. Warmer temperatures with decreased snowfall could have an impact on a particular plants ability to sustain itself within its current range. An increased length of growing season in higher elevations could lead to a corresponding variation in vegetation and change in species composition. These types of changes would be most significant for special status plants that typically occupy a very specific ecological niche. Cool season plant species' spatial ranges are predicted to move north and to higher elevations, and extinction of endemic threatened or endangered plants may be accelerated. Invasive plant species would be more likely to out-compete native species.

Increases in winter temperatures in the mountains could have impacts on traditional big game migration patterns. Due to loss of habitat, or due to competition from other species whose ranges may shift northward, the population of some animal species may be reduced. Warmer winters with less snow would impact the Canada lynx by removing a competitive advantage they have over other mountain predators. Earlier snowmelt could also have impacts on cold water fish species that occupy streams throughout the planning area. Climate change could affect seasonal frequency of flooding and alteration of floodplains, which could impact riparian conditions. More frequent and severe droughts would have impacts on many wildlife species throughout the region as well as vegetative composition and availability of livestock forage in some areas. Climate change could increase the growing season within the region, which could result in more forage production provided there is sufficient precipitation. Drier conditions could have severe impacts on forests and woodlands and could leave these areas more susceptible to insect damage and at higher risk of catastrophic wildfires. Increased fire activity and intensity would increase greenhouse gas emissions, providing for a negative feedback loop. In fact most of the predicted changes on a global scale have some level of a predicted negative feedback loop, exacerbating adverse impacts.

Potential Future Mitigation:

Substantial emission-generating activities cannot occur without further BLM analysis and approval of proposals for exploration and development operations. BLM may make its approval of these activities subject to COA addressing air pollutant emissions, as appropriate. Prior to approving development activities on a leased parcel, BLM would conduct a project level impacts analysis that would consider the impacts of the operator's development plans for the lease, to the extent reasonably foreseeable. BLM's analyses would typically consider the emissions inventory for the proposal, and estimated emissions from other reasonably foreseeable development on and outside the lease. All operators must comply with applicable local, State and Federal air quality laws and regulations. As described in the lease notice CO-56 that would be attached to the leases in the proposed action, BLM may require additional analyses (such as air dispersion modeling assessments) or impose specific mitigation measures within its authority as COA, based on the review of site-specific proposals or new information about the impacts of exploration and development activities in the region. Oil and gas resources may be developed and produced

subsequent to the proposed lease sale and may ultimately be utilized to produce energy. BLM would evaluate potential impacts of emissions of regulated air pollutants (including GHGs) associated with the development of the oil and gas resources in a subsequent NEPA analysis at the lease development (typically APD) stage. Project specific GHG emissions can generally be quantified and compared to overall sector, regional, or global estimates to provide some estimate of the level and significance of any potential impacts. BLM would continue to evaluate climatic variability and change in the future, and apply appropriate management techniques and policy to address changing conditions as developments in such methods and policy occur.

3.4.1.2 Flood Plains

Affected Environment:

Flooding is the temporary inundation of an area caused by overflowing streams or by runoff from adjacent slopes (water standing for short periods after rainfall or snowmelt is not considered flooding). The USDA NRCS Web Soil Survey data identifies the Flooding Frequency Class of Parcel 7416 in its entirety is rated as “none”. Approximately two acres in the southwest corner of Parcel 7429 is rated “frequent” with the remainder of the parcel rated as “none”.

Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. "Frequent" means that flooding is likely to occur often under normal weather conditions. The chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year. "None" means that flooding is not probable. The chance of flooding is nearly 0 percent in any year. Flooding occurs less than once in 500 years.

Regardless of surface ownership, no ground-disturbing activities or structure development would occur within FEMA-identified 100-year floodplain (per Executive Order 11988 on Floodplain Management).

The term "100-year flood" is used in an attempt to simplify the definition of a flood that statistically has a 1-percent chance of occurring in any given year. The two acres within Parcel 7429 fall within this definition.

The lease stipulations for Parcel 7429 include No Surface Occupancy (NSO) stipulation LS-105 for the southern one quarter of the parcel which falls within one quarter mile of the perennial stream Slater Creek.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

There would be no direct or indirect impacts to flood plains since surface disturbing activities would not be authorized within the identified flood plains.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

The potential for cumulative impacts to floodplains as a result of implementing the proposed action combined with past, present, and reasonably foreseeable future actions is negligible, since modification of identified floodplains is prohibited.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved Best Management Practices (BMPs) to protect flood plains, would be analyzed and added at the APD stage, as appropriate.

3.4.1.3 Hydrology/Ground

Affected Environment:

Groundwater hydrology is the occurrence, distribution, and movement of water below the surface of the earth (Todd, 1980). The Colorado Oil and Gas Conservation Commission (COGCC) defines groundwater as subsurface waters in a zone of saturation. These saturated zones typically have an impermeable or semi-impermeable layer below them. Springs can occur at the outcrop of saturated zones that allows the flow of groundwater. Both parcels are within the southeastern portion of the Sand Wash Basin which contains the Mesaverde and Dakota aquifer hydrogeologic units. In these areas, the Cretaceous-age target aquifers exist at depths less than 2,000 feet (Topper, 2003). The Browns Park Formation that covers a little over half of Parcel 7429 is likely to contain localized aquifers.

There are two water wells within one mile of the boundary of Parcel 7429 (CDWR) with drilled depths of 200 and 440 feet.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

There are no direct impacts to groundwater hydrology as a result of this lease sale. Indirect impacts to groundwater resources could result from drilling through groundwater zones and surfacing disturbing activities associated with the exploration and development of proposed parcel.

Drilling would most likely pass through hydrogeologic units. Potential impacts to groundwater hydrology resources could occur if proper cementing and casing programs are not followed. This could include loss of well integrity during the drilling and completion process. Loss of well integrity could allow aquifer zones to become interconnected and locally alter the hydrologic characteristics of the affected aquifers. Site specific geologic conditions and drilling practices determine the probability of this occurrence.

Hydraulic fracturing could change the physical properties of the oil and gas producing formations by increasing the flow of water, gas, and/or oil around the well bore. There also could be the potential for migration of oil, gas, and water from one formation to another.

Federal Oil and Gas Onshore Order #2 requires that the proposed casing, cementing and abandonment programs shall be conducted as approved to protect and/or isolate all usable water zones.

The COGCC requires that the well components be designed to manage the site and reservoir specific pressures. Rule 317.d mandates that well casings be “planned and maintained” to “prevent the migration of oil, gas or water from one (1) horizon to another.” Rules 317.g and 317.h set forth specific cementing requirements. And Rule 317.j requires production casing to be “adequately pressure tested for conditions anticipated to be encountered during completion and

production operations.” In addition, Rule 341 requires operators to monitor the well’s bradenhead pressure during hydraulic fracturing and to report promptly to the COGCC any significant pressure increase. Monitoring these pressures helps to indicate if hydraulic fracturing fluids have escaped the target formation.

Potential impacts to groundwater hydrology at site specific locations are analyzed at the development stage when the APD is submitted. This process includes geologic and engineering reviews to ensure that cementing and casing programs are adequate to protect all downhole resources including the groundwater hydrology.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

Throughout the 5th level watershed scale CIAAs there are many activities currently occurring, along with historic impacts, which could affect the groundwater hydrology. These activities include: oil and gas development, residential development, grazing, mining, and recreation. The leasing and subsequent development of these parcels would add an additional impact to water resources into the future. Most of this impact would be phased in and lessened as individual wells are completed and older wells are plugged and abandoned. Overall, it is not expected that the leasing and possible future development of the parcels would adversely affect the groundwater hydrology of the CIAAs.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect hydrologic resources, would be analyzed and added as COAs at the APD stage, as appropriate.

3.4.1.4 Hydrology/Surface

Affected Environment:

Parcel 7416 (Attachment E, Map 7) is approximately 170 acres in the Williams Fork watershed. It is divided by a southeast trending ephemeral drainage with side slopes averaging 25 percent or greater. Portion of the parcel have been identified as having fragile soils and slopes 35 percent or greater. It is approximately 2.7 drainage miles from the Williams Fork River with elevation ranging from 7,100 to 7,600 feet in elevation. There are five springs and six constructed reservoirs within one mile of the boundary Parcel 7416.

Parcel 7429 (Attachment E, Map 4) is an approximately 640 acre tract in the Slater Creek Watershed with a southwestern aspect and has an average slope of less than 15 percent. Approximately 0.1 miles of Slater Creek transects the southwestern most corner. The remaining southern portion of the parcel is within 0.25 miles of Slater Creek. Several surface water features (shallow ponds) are present on the tract. Portions of the parcel have been identified as having fragile soils and slopes 35 percent or greater. There are three points of spring diversions and one constructed reservoir within one mile of the boundary of Parcel 7429 (CDWR).

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

There are no direct impacts to surface hydrology as a result of this lease sale. Indirect impacts to surface hydrology could result if surfacing disturbing activities associated with the exploration

and development of the parcels occur on the proposed parcels. These activities could consist of well pads, access roads, pipelines, and processing facilities. These impacts are typically addressed through the stormwater management plan the operator is required to develop, and may be modified by BLM during approval. Parcel 7429 includes NSO stipulation LS-105 for areas up to 0.25 mile from perennial water sources. Portions of both parcels contain Controlled Surface Use (CSU) stipulations LS-110 and LS-111 that address surface disturbing activities on fragile soils and slopes 35 percent or greater. Implementation of the CSUs and NSO would be determined during onsite visits and subsequent environmental analysis. If required, implementation would minimize impacts to surface hydrology in these areas.

The surface hydrology could be impacted in some areas where BMPs fail or where intense localized thunderstorms overwhelm drainage features. Drainage features for roads and pads are typically designed for the 10-year and 25-year storm events, but more extreme storms are possible and surface disturbance from oil and gas development could increase the peak flow of these events and create erosion and sedimentation due to increased runoff and changes in surface hydrology. These impacts are more likely for surface disturbance in areas with poor soils, unstable soils and steep slopes.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

Future, current, and historic activities which could affect surface hydrology in both areas include: oil and gas development, residential development, grazing, water retention projects, irrigation, mining (gravel operations in both parcels and; surface and underground coal mining in the Williams Fork watershed), and recreation. In the CIAA, the leasing and subsequent development of these parcels could add an additional impact to surface hydrology into the future. Most of this impact would be phased in and lessened as individual wells are completed, interim reclamation is achieved, and older wells are plugged and abandoned.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect hydrologic resources, would be analyzed and added as COAs at the APD stage, as appropriate.

3.4.1.5 Minerals (Fluid and Solid) and Geology

Affected Environment:

The parcels are located in the Sand Wash Basin of the Southwestern Wyoming Province with the surficial geology of the parcels ranging in age from the Cretaceous Iles Formation in Parcel 7416 to the Tertiary Browns Park Formation in Parcel 7429. Site specific geology would be identified during the APD process. All of the nominated parcels are within the high oil and gas occurrence area in the RMP. Approximately 565,000 acres (33 percent) of the area available for federal oil and gas development within the LSFO is currently leased. Previous leasing of the nominated lands is indicative of past and current interest in oil and gas development of these parcels. Ninety percent of Parcel 7416 is bordered by fee oil and gas estate and the remaining 10 percent borders the Williams Fork Federal Exploratory Oil and Gas Unit (COC74956X). Approximately 62.5 percent of Parcel 7429 is bordered by existing federal oil and gas leases, 12.5 percent by fee oil

and gas, and the remaining 25 percent by unleased federal minerals. COGCC oil and gas well database indicates no previous oil and gas development has occurred on either of the parcels.

Neither of the parcels is encumbered by active mining claims.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

Sale of the parcels would allow development and recovery of oil and natural gas resources in the underlying oil and gas bearing formations. Drilling and completion of production wells could occur to develop the proposed parcels. The completion process may or may not include hydraulic fracturing. Injection wells could also be constructed for the disposal of produced water. The operator is required to submit an APD and receive approval prior to any well construction activity. Well design and configuration would be included in the APD submittal. A NEPA review would be conducted prior to APD approval. Oil and gas related injection wells are permitted and regulated by the COGCC as Class II Underground Injection Control (UIC) wells. Class II wells are used specifically to inject oil and gas exploration and production waste for disposal, and for enhanced oil recovery through injection of water, gas, or other substances.

Induced seismicity events (man-made earthquakes) are known to occur in a limited number of locations from the use of injection wells. The National Research Council's (NRC) report on "Induced Seismicity Potential in Energy Technologies" (NRC 2013) notes that the majority of wastewater disposal wells do not pose a hazard for induced seismicity, though there have been induced seismic events with a very limited number of wells.

The COGCC Class II UIC permit process involves the review and approval of well construction, isolation of ground water aquifers, maximum injection pressures and volumes, injection zone water quality, and potential for seismicity. The seismic review uses Colorado Geological Survey (CGS) geologic maps, the United States Geological Survey (USGS) earthquake database, and area-specific knowledge to assess seismic potential. If historical seismicity has been identified in the vicinity of a proposed Class II UIC well, COGCC requires an operator to define the seismicity potential and the proximity to faults through geologic and geophysical data prior to any permit approval.

NRC's report also concluded the process of hydraulic fracturing as presently implemented for shale gas recovery does not pose a high risk for felt seismic events.

During drilling operations on the parcels, loss of circulation or problems cementing the surface casing may affect freshwater aquifer zones encountered. The LSFO ensures the submitted APD would contain a casing and cementing program adequate to protect all of the resources, minerals, and fresh water zones, as per 43 CFR §3162.5-2(d).

Parcel 7416 was originally mapped with a NSO stipulation (LS-129) for areas within federally leased coal lands for surface coal mines where oil and gas development would likely be incompatible with coal extraction. However, this parcel has no active mining and is located greater than 0.5 miles south of a federal coal lease and the Trapper Mine permit boundary. Encumbering Parcel 7416 with LS-129 could hinder the development of underlying and adjacent oil and gas resources by precluding associated surface development for the recovery of oil and

gas resources. Expansion of the Trapper Mine is expected to continue to the east and not south onto the parcel. It is unlikely the oil and gas development of the Parcel 7416 would interfere with surface coal mining operations; therefore, LS-129 was removed from Parcel 7416.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

As mentioned above approximately 33 percent of BLM-administered federal oil and gas mineral estate within the LSFO is currently leased for oil and gas. The amount of oil and gas leased lands is a decrease from more than 60 percent of the federal mineral estate that was leased as of 2005 (RFD). This decrease is attributed to expiration of the ten year lease terms and termination of nonproducing leases. Sale of the proposed parcels would not noticeably increase (less than 0.05 percent) the area of federal oil and gas estate currently leased. Direct, indirect, and cumulative effects of reasonably foreseeable oil and gas development are analyzed in the Little Snake RMP/EIS, which addresses oil and gas development, including roads and pipelines, over a 20 year period. The two offered parcels have been previously leased within the last 20 years and/or are adjacent to currently authorized federal oil and gas leases. The impacts of the proposed oil and gas leasing in this EA, as well as cumulative impacts to the Resource Area, are within the scope of analysis in the RMP/EIS.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect fluid mineral resources, would be analyzed and added at the APD stage, as appropriate.

3.4.1.6 Soils

Affected Environment:

The type and classification of soils, as well as the magnitude and location of direct and indirect effects on soil resources cannot be predicted until site-specific proposals are made, should exploration and development be authorized. Both of the nominated parcels have the potential for fragile soils based on the presence of slopes greater than 35 percent and/or because soil types are rated as highly or severely erodible by wind or water. Due to the private surface ownership of the parcels, the nature and condition of soils there would not be known until a field visit can be conducted.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

There are no direct impacts to soils as a result of this lease sale. Indirect impacts to soils could result if surfacing disturbing activities associated with the exploration and development of the parcels occurs on the proposed parcels. These activities could consist of well pads, access roads, pipelines and processing facilities. The RFD estimates a little over 16 acres of disturbance associated with each well pad and a down-hole spacing ranging from 80 to 160 acres in the Sand Wash Basin. Full development of the leases could involve 5 to 10 single well pads (80 acres to 160 acres of disturbance). Technological advances in drilling techniques could allow the use of directional and horizontal drilling and multiple wells per pad which could reduce the total number of well pads and disturbance.

Impacts resulting from the construction of related infrastructure would include removal of vegetation, exposure of the soil, mixing of horizons, compaction, loss of topsoil productivity,

susceptibility to wind and water erosion, and possible contamination of soils with petroleum constituents. These impacts could result in increased indirect impacts such as surface water runoff; sheet, rill or gully erosion; and off-site sedimentation in areas downstream/down gradient of this disturbance, especially following rain and snow melt events.

Decreased soil productivity as a result of the loss of topsoil has the potential to hinder revegetation efforts and leave soils further exposed to erosion. Grading, trenching, and backfilling activities may cause mixing of the soil horizons which could diminish soil fertility and reduce the potential for successful revegetation. Segregation and reapplication of surface soils would result in the mixing of shallow soil horizons, resulting in a blending of soil characteristics and types. This blending would modify physical characteristics of the soils, including structure, texture, and rock content, which could lead to reduced permeability and increased runoff from these areas.

Contamination of surface and subsurface soils can occur from leaks or spills of oil, produced water, and condensate liquids from wellheads, produced water sumps, and condensate storage tanks. Leaks or spills of drilling and hydraulic fracturing chemicals, fuels, and lubricants could also result in soil contamination. Such leaks or spills could compromise the productivity of the affected soils. Depending on the size and type of spill, the impact to soils would primarily consist of the loss of soil productivity. Typically, contaminated soils would be removed and disposed of in a permitted facility or would be bio remediated in place using techniques such as excavating and mulching to increase biotic activities that would break down petrochemicals into inert and/or common organic compounds.

Controlled Surface Use Stipulations (CSU) for the protection of soils occurring on fragile soils (LS-110) and on slopes 35 percent or greater (LS-111) are attached to portions of both of the nominated parcels. Surface disturbing activities within these areas would require an approved engineered reclamation plan and adherence to performance objectives listed in Attachment D. In addition, BMPs, based on site visits and environmental review, would be attached as COA at the APD stage.

Properly implemented and maintained CSUs and BMPs would limit impacts to the soil resources and maintain Public Land Health Standards.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

Leasing of the parcels in addition to the past, present and reasonably foreseeable actions would elevate the potential for the deterioration of soil health. Increased development of fluid minerals would result in a cumulative increase in surface disturbances as well as increased potential for leaks or spills during drilling and completion activities. The type of impacts would be the same as described under environmental impacts associated with the proposed action. However, the severity of the impacts could be elevated with an increase in mineral development.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect soils resources, would be analyzed and added at the APD stage, as appropriate.

3.4.1.7 Ground Water Quality

Affected Environment:

Groundwater hydrologic units of both parcels include the underlying Mesaverde and Dakota aquifers. An alluvial aquifer may be present along Slater Creek and there could be local aquifers associated with the Browns Park Formation in Parcel 7429. Also see 3.4.1.3 Hydrology/Groundwater Affected Environment.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

The act of leasing the parcels for oil and gas development would have no direct impact on water resources; however activities at the exploration and development stage could have impacts to water quality and quantity. At the leasing stage, it is not known how many potential wells would be drilled, the well construction techniques (vertical or directional, including horizontal) and whether or not hydraulic fracturing would be utilized. The magnitude and location of direct and indirect effects cannot be predicted with accuracy until the site-specific APD stage of development. Lease stipulations for the proposed Parcel 7429 specifically address either surface or groundwater quality. Stipulations LS-110 and LS-111 address soils and slope stability issues that would directly protect soils and water quality by minimizing erosion. The leasing of these parcels would not affect whether or not these lands meet Public Land Health Standards; but development could negatively affect water quality. With proper BMP implementation, water quality should still meet standards with future development.

Water usage for drilling and hydraulic fracturing of oil and gas wells is considered at the APD stage. Many factors, such as well type, depth, and the use of recycled water, influence the amount, timing and location of water used in oil and gas development. Based on wells drilled between August 2012 and August 2015 in the same general area, the required amount of water to drill and complete a well, including recycled water, on the proposed parcels could vary from less than 100,000 gallons to over 3million gallons (FracFocus). Water usage is largely regulated by the State of Colorado's water rights system and operators would need to obtain a legal source of water. The Colorado Division of Water Resources projects the total amount of water used for hydraulic fracturing in 2015 would be slightly more than one-tenth of one percent of Colorado's total water use (CDWR_b).

At the leasing stage, the amount of produced water and flowback of injected hydraulic fluid is not known. The amount wastewater for each well is dependent on the type of well, well design, method of well completion, and site specific conditions of the targeted geologic formation. As part of the APD submittal, federal Onshore Oil and Gas Order #1 and #7 requires the operator to submit a Surface use Plan of Operations (SUPO) that contains a written description of the methods and locations proposed for safe containment and disposal of each type of waste material including drilling fluids and produced water. The information provided in the SUPO is used in the NEPA analysis for the APD. Depending on the quality and amount of wastewater may be evaporated on site, piped, or trucked to an approved disposal sites, including disposal wells.

If the proposed parcels are developed, drilling would most likely pass through useable groundwater aquifers. Potential impacts to groundwater resources could occur if loss circulation zones are encountered or if proper cementing and casing programs are not followed. Loss of

circulation could introduce drilling fluids into the water producing formations. Improper cementing and loss of casing integrity casing could allow migration of fluids between formations. Site specific conditions and drilling practices determine the probability of this occurrence and determine the groundwater resources that could be impacted.

Federal Oil and Gas Onshore Order #2 requires that the proposed casing, cementing and abandonment programs shall be conducted as approved to protect and/or isolate all usable water zones. Known water bearing zones would be protected by drilling requirements and, with proper practices, contamination of ground water resources is highly unlikely. Surface casing would be extended through fresh-water zones cemented to surface to isolate fresh water zones.

Types of chemical additives used in drilling activities may include acids, hydrocarbons, thickening agents, lubricants, and other additives that are operator and location specific. These additives are not always used in these drilling activities and some are likely to be benign, such as bentonite clay and sand. Concentrations of these additives also vary considerably since different mixtures can be used for different purposes in oil and gas development and even in the same well bore. Hydraulic fracturing creates fractures in the formation to increase properties of producing formations by the flow of water, gas, and/or oil near the hydraulic fractured portion of the production zone of the well bore, and can also introduce chemical additives into the producing formations. If contamination of aquifers from any source occurs, changes in groundwater quality could impact nearby springs and residential wells that are sourced from the affected aquifers.

The EPA is conducting a hydraulic fracturing study of the potential impacts of hydraulic fracturing to drinking water resources. Their draft assessment concluded that there are above and below ground mechanisms by which hydraulic fracturing activities have the potential to impact drinking water resources. These mechanisms include; water withdrawals in times of, or in areas with, low water availability; spills of hydraulic fracturing fluids and produced water; fracturing directly into underground drinking water resources; below ground migration of liquids and gases, and inadequate treatment and discharge of wastewater. The EPA did not find evidence that these mechanisms have led to widespread, systemic impacts on drinking water resources in the United States (EPA).

The COGCC requires that the well components be designed to manage the site and reservoir specific pressures. Rule 317.d mandates that well casings be “planned and maintained” to “prevent the migration of oil, gas or water from one (1) horizon to another.” Rules 317.g and 317.h set forth specific cementing requirements. And Rule 317.j requires production casing to be “adequately pressure tested for conditions anticipated to be encountered during completion and production operations.” In addition, Rule 341 requires operators to monitor the well’s bradenhead pressure during hydraulic fracturing and to report promptly to the COGCC any significant pressure increase. Monitoring these pressures helps to indicate if hydraulic fracturing fluids have escaped the target formation.

COGCC Rule 609 requires oil and gas operators to sample water sources within ½ mile of a proposed well within 12 months prior to setting conductor pipe and subsequent samplings between 6 and 12 months and between 60 and 72 months following the completion of the well.

Potential impacts to groundwater at site specific locations would be analyzed at the development stage when the APD is submitted. This process includes geologic and engineering reviews to ensure that cementing and casing programs are adequate to protect all downhole resources.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

Throughout the 5th level watershed scale CIAAs there are many activities currently occurring, along with historic impacts, which could affect the groundwater hydrology. These activities include: oil and gas development, residential development, grazing, mining, and recreation. The leasing and subsequent development of these parcels would add an additional impact to water resources into the future. Most of this impact would be phased in and lessened as individual wells are completed and older wells are plugged and abandoned. Overall, it is not expected that the leasing and possible future development of the parcels would cause long term degradation of groundwater quality below State standards.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect groundwater resources would be analyzed and added at the APD stage, as appropriate.

3.4.1.8 Surface Water Quality

Affected Environment:

Parcel 7416 is situated in the Williams Fork Watershed and Parcel 7429 is situated in the Slater Creek Watershed. Neither of these two watersheds contains tributaries identified by the State of Colorado Department of Public Health and Environment (CDPHE) as having impairments (Clean Water Act 303(d) List).

Parcel 7416 is approximately 2.7 ephemeral drainage miles from the Williams Fork River. There are five springs and six constructed reservoirs within one mile of the boundary Parcel 7416.

Approximately 0.1 miles of Slater Creek transects the southwestern most corner Parcel 7429 (Attachment E, Map 4). The remaining southern portion of the parcel is within 0.25 miles of Slater Creek. Several surface water features (shallow ponds) are present on the tract. Portions of the parcel have been identified as having fragile soils and slopes 35 percent or greater. There are three points of spring diversions and one constructed reservoir within one mile of the boundary of Parcel 7429 (CDWR).

Portions of both parcels have been identified as having fragile soils and slopes 35 percent or greater.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

There are no direct impacts to water quality as a result of this lease sale. However, impacts to surface water resources could be associated with the surface disturbance from the construction of roads, pipelines, well pads, and power lines. Specific impacts would be soil compaction caused by construction that would reduce the soil infiltration rates, in turn increasing runoff during precipitation events. Downstream effects of the increased runoff may include changes in downstream channel morphology such as bed and bank erosion. Impacts would be greatest

shortly after the start of the activity and decrease over time. These impacts would be mitigated by the implementation of storm water BMPs that would design facilities with temporary runoff control measures that would slow down runoff and capture sediment. These BMPs would be applied at the APD stage to address site specific conditions (also see Groundwater Quality Section 3.4.1.7 for direct and indirect impacts).

Chemicals, produced water, oil, or other fluids, accidentally spilled or leaked during the development, production, storage, and transportation could result in the contamination of both ground and surface waters. Through the third quarter of 2015 the percentage of produced water and oil spilled in Colorado was 0.013 percent and 0.002 percent, respectively, of the water and oil produced from 53,054 active wells in the same time period (COGCC_b). Authorization of development projects would be further analyzed at the APD stage and permits would require full compliance with BLM directives that relate to surface and groundwater protection.

The perennial water source NSO stipulation (LS-105) on Parcel 7429 contains measures to protect water resources. Steep slope and fragile soils CSU stipulations (LS-110 and LS-111) on both parcels protect sensitive soils that could contribute to surface water quality degradation if disturbed. Collectively, these stipulations, and BMPs that could be added at the APD level, are designed to protect areas from excessive erosion and subsequent sedimentation that could impact surface water quality. As mentioned in 3.4.1.4 Hydrology/Surface, BMPs may fail from intense localized thunderstorms, overwhelming drainage features and increasing sediment load.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

Throughout the 5th level watershed scale CIAAs there are many activities currently occurring, along with historic impacts, which could affect the groundwater hydrology. These activities include: oil and gas development, residential development, grazing, mining, and recreation. The leasing and subsequent development of these parcels would add an additional impact to water resources into the future. Most of this impact would be phased in and lessened as individual wells are completed, interim reclamation is established, and older wells are plugged and abandoned. Overall, it is not expected that the leasing and possible future development of the parcels would cause long term degradation of surface water quality below State standards.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect surface water resources, would be analyzed and added at the APD stage, as appropriate.

3.4.2 Biological Resources

3.4.2.1 Invasive/Non-Native Species

Affected Environment:

The state of Colorado has three designations for noxious weeds that occur in the state:

- List A species are designated for eradication;
- List B species have, or will have, a state noxious weed management plan developed to stop their spread; and;
- List C species are species that entities who have been authorized to cause disturbance will develop and implement noxious weed management plans designed to support the efforts

of local governing bodies to facilitate more effective integrated weed management on private and public lands. The goal of such plans is not necessarily to stop the continued spread of these species but instead to provide additional education, research, and biological control resources to jurisdictions that choose to require management of List C species (Colorado Department of Agriculture 2011).

Several Colorado listed noxious weed species occur within or near the proposed parcels and are listed in Table 3-12, however, this list is not all inclusive. At the APD stage a weed survey would provide a comprehensive weed species list for the project area.

Table 3-12. Primary perennial weed species in LSFO.

Common Name	Listed Designation
downy brome (cheatgrass)	C
hoary cress (white top)	B
leafy spurge	B
Russian knapweed	B
houndstounge	B
Dalmatian toadflax	B
Canada thistle	B
musk thistle	B
Scotch thistle	B
bull thistle	B

Downy brome (cheatgrass), bulbous bluegrass, yellow alyssum, blue mustard and other annual weeds are common along roadsides and in other disturbed areas. Other species of noxious weeds can be introduced by vehicle traffic, livestock and wildlife. On-going development would continue to occur in the vicinity of the proposed lease areas and the associated risk for the spread of noxious and invasive weeds.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

The lease sale itself would have no direct or indirect impacts to plant communities in the affected areas.

Where leasing and development occurs there would be additional disturbance throughout the project areas creating opportunity for noxious weeds to establish and/or spread. Cheatgrass and other weedy annuals are common along roadsides and other disturbed areas. These and other species of noxious weeds are spread by vehicle traffic, livestock, wind, water, recreational vehicles, and wildlife. There would also be potential for new weeds to be transported into the development site areas on equipment used for construction activities. Any disturbance of soil or removal of vegetation would create opportunity for weeds to establish or spread into the

surrounding plant community. In disturbed areas, bare soils and the lack of competition from an established perennial plant community would allow weed species opportunity to grow and produce seed. However, successful reclamation using a seed mix adapted to the site in conjunction with integrated weed management would create an opportunity to improve vegetative communities and reduce the amount of weedy species in the project area.

At the APD stage, the operator would be required to control any invasive and/or noxious weeds that become established within the disturbed areas and surrounding area of influence and continue weed control actions throughout the life of each project through final abandonment. Employing site specific weed management including principles of integrated pest management, and herbicide application would reduce noxious and invasive weed establishment.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

The Proposed Action would not add substantially to existing or proposed disturbances in the CIAA, since there would be no surface disturbing activities due to the sale of the lease. A more site-specific analysis would be done at the APD stage to identify any populations or vectors. Invasive species would be treated as COAs require that weed populations be kept in check or even eradicated through timely pesticide application and reclamation procedures. Successful reclamation would reduce the risk to healthy plant communities and provide an opportunity to improve degraded vegetative communities within the project area.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect against invasive/non-native species would be analyzed and added at the APD stage, as appropriate. All principles of Integrated Pest Management would be employed to control noxious and invasive weeds on public lands.

3.4.2.2 Migratory Birds

Affected Environment:

A number of migratory birds fulfill nesting functions in the aspen, mountain shrub, and mixed shrubland communities encompassed by the proposed parcels. Core nesting activity generally extends from mid-May through late July depending on elevation with estimated nest densities of about 0.5 to 1 nesting pair per acre. Migratory birds present in the proposed lease tracts that have been identified as being of conservation concern include Brewer's sparrow (all forms of big sagebrush-dominated shrublands) and flammulated owl and Cassin's finch (mature aspen woodlands). These birds are either BLM-sensitive (i.e., Brewer's sparrow) or associated with the most recent FWS list of Birds of Conservation Concern for Bird Conservation Region 16, Southern Rocky Mountains/Colorado Plateau, all of which are birds that without conservation actions may become candidates for listing under the Endangered Species Act. Other migratory birds of conservation interest (e.g., Partners in Flight birds of conservation interest) include: purple martin, MacGillivray's warbler, and red-naped sapsucker (mature aspen especially near water), and Virginia's warbler and green-tailed towhee (deciduous shrublands).

Table 3-13. Major Migratory Bird Nest Habitat Associations of Proposed Parcels

Proposed parcel	Habitat associated with BLM-sensitive, USFWS Birds of Conservation Concern, and Partners in Flight species of conservation interest encompassed by lease proposals (acres)		
	Aspen	Big sagebrush dominated shrublands	Mixed shrub and mountain shrublands
7416	0	21	143
7429	262 (154 mature)	23	340
Total acreage by type	262	44	483
% of total lease parcels	32 (19 mature)	5	59

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

Table 3-13 depicts habitats available to the birds in the proposed parcels. Based on the character of adjacent developments and long-term average development figures for similar developments in northwest Colorado, it is estimated that development-related vegetation clearing at full build-out would involve about 2 to 5 percent of each vegetation community. Vegetation modifications in woody shrublands and woodlands would persist for decades, but their influence on nest habitat utility and avian nesting density would depend largely on their eventual configuration. Due to the mobility of birds, the limited proportion of habitat physically disturbed over the life of the lease, and the remaining pattern and distribution of habitat available for nesting (particularly once intensive development phases are complete), narrow corridors or patches of unsuitable or matrix habitat separating large tracts of intact habitat are not expected to constitute barriers to movement within or between habitat parcels. Although larger blocks of mature habitat in general would be expected to support a richer and more abundant avian community, less optimal or compromised habitats that adjoin or separate higher value habitats (matrix habitats) can generally be expected to be occupied by a full complement of associated species at lesser density.

Although the response is species-specific, migratory birds tend to avoid siting nests in close proximity to disturbance. Inglefinger and Anderson (2004) found the nesting density of sagebrush-associated birds was reduced by 40-60 percent within 330 feet of roads accessing natural gas fields in Wyoming with as few as 10 vehicle trips per day. Although similar response would be expected in other open shrubland habitats, this influence is likely moderated where intervening foliar or topographic screening would attenuate aural and visual cues (Helldin 2003; Reijnen 2006). Recent work from Wyoming gas fields (Gilbert and Chalfoun 2011) documents 10-20 percent declines in the abundance of certain sagebrush obligates (i.e., sage and Brewer's sparrow) in developed natural gas fields at well densities of 21 per square mile. The ultimate fate of birds displaced by development activity is not known, but it is likely that suitable habitats are generally at capacity and these birds must occupy suboptimal habitats to fulfill nesting functions. Reproductive success and recruitment would be assumed to be substantially lower in these situations. Conversely, there is no strong evidence to suggest that habitats vacated by birds

intolerant of disturbance would not regain much of their former utility once intense activity subsides, particularly where traffic volumes are low during the decades-long production phase and affected acreage is contiguous with large tracts of intact and largely unaffected source habitat (Riffell et al. 1996).

Impacts to migratory bird breeding populations in the immediate vicinity of the leases are expected to result in population declines more or less directly proportional to the extent of habitat adversely modified at any given time (i.e., no declines attributable to area-effects) and collective migratory bird habitat modification is expected to remain minor with measurable influence on the abundance or distribution of local breeding populations apparent only at the most local scale.

Siting constraints are routinely applied as a COA to habitats that support birds of higher conservation status. Long term conversion of higher value habitats can often be avoided or substantially reduced by realigning or moving proposed facilities to younger woodland stands, habitats with degraded understories, habitats in closer proximity to existing forms of disturbance, and the margins of habitat parcels. These moves are site-specific, generally less than 200-meters, and are normally negotiated with the operator during on-site inspections. In those instances where avoidance of higher value habitats is unavoidable, 60-day timing restrictions (COAs) remain available to avoid the core nesting season (range of 15 May – 30 July depending on elevation) and reduce, as much as practicable, direct mortality attributable to initial vegetation clearing and high intensity development operations.

Fluid storage, whether in earthen pits or open tanks, presents a potential hazard for birds. Bird mortality may result from exposure to fluids associated with oil and gas development that are toxic, compromise the insulative properties of bird plumage, or pose a drowning risk. Operators are required to prevent migratory bird use of or access to such fluids.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

The CIAA for this analysis is the Little Snake Field Office, which encompasses 4.2 million acres in the northwest corner of Colorado. Development of these leases would represent an incremental increase in woody nesting habitat modified in the course of pad, road, and pipeline construction across the LSFO. Except for ground-nesting birds (e.g., western meadowlark, vesper sparrow, gray-headed junco), there would be little effective redevelopment of nesting substrate for woodland or shrubland associates in the short term. In the longer term, higher elevation aspen and mountain shrub communities would be expected to rapidly redevelop former attributes once facilities are abandoned and reclaimed.

Avoidance behavior (e.g., habitat disuse along access roads) would tend to moderate as more intensive lease development activities subside during production, but minor residual influences would be expected to continue and contribute cumulatively with all forms of land activity until final abandonment.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect migratory birds would be analyzed and added at the APD stage, as appropriate. These

measures may include, but would not be limited to, timing limitations during the core nesting season, siting adjustments to avoid higher quality nest habitat, and requiring that the operator prevent migratory bird access to facilities that store or are expected to store fluids that may pose a mortality risk to birds.

3.4.2.3 Special Status Animals

Affected Environment:

The lease parcels do not encompass any mapped Canada lynx habitat and the predominant vegetation communities composing the lease parcels are not conducive to the support of denning or winter foraging habitat and by themselves are considered non-habitat. The nearest mixed conifer stands capable of supporting snowshoe hare, the dietary staple of lynx, are a minimum of 0.7 mile from the nearest lease boundary (Parcel 7429).

Neither parcel involves suitable greater sage-grouse habitat. The nearest mapped General Habitat Management Area is located 2.5 miles east and 1.6 miles north of Parcel 7429; the nearest Priority Habitat Management Area is 2.9 to 4.1 miles to the north. Big sagebrush-dominated shrublands occur as small scattered inclusions in a deciduous shrub dominated matrix and are a minor in relative extent (i.e., 12 and 4 percent of Parcels 7416 and 7429, respectively).

The parcels are well removed from the Yampa River as critical habitat for the endangered Colorado pikeminnow and razorback sucker (12 valley miles downstream of Parcel 7416; 98 valley miles downstream of Parcel 7429).

Based on most recent CPW mapping, both lease parcels are encompassed by extensive Columbian sharp-tailed grouse (CSTG) winter range. CSTG are a BLM-sensitive species and CPW species of special concern. CSTG range associated with lease parcel 7429 lies on the margin of overall CSTG range encircling the Elkhead Mountains between Steamboat Springs and Craig, Colorado. These are high elevation CSTG habitats that are characterized by aspen and deciduous shrublands interspersed with permanent and seasonal wetlands (see vegetation community breakdown in Migratory Bird section). CSTG habitat associated with lease parcel 7416 is composed of mature mid-elevation serviceberry and oakbrush-dominated shrublands interspersed with sagebrush bottomlands.

The following information pertaining to Columbian sharp-tailed grouse (CSTG) was derived principally from the following publications: Hoffman 2001, Hoffman and Thomas 2007, and Hoffman et al. 2015.

CSTG in northwest Colorado occupy seasonally distinct home ranges corresponding to the spring-fall and winter periods. CSTG normally begin moving from spring-fall habitats to their traditionally favored winter range areas by early November. Ideal winter habitat is composed of relatively open, taller-statured (>3 feet tall) serviceberry and chokecherry stands that are well-distributed across a landscape, preferably in close proximity to aspen and within 2.5 to 4 miles of the associated lek. The buds of serviceberry, chokecherry, and aspen form the birds' primary winter forage base. Lease tract 7429 lies within 2.5 miles of one CSTG lek and 4 miles of four lek sites. Lease tract 7416 lies within 4 miles of at least five lek sites. Deciduous and mixed shrublands capable of serving as CSTG winter habitat are estimated to comprise about 57% of

lands offered for Lease Parcel 7429 and 95% of lands offered for Lease Parcel 7416. CSTG congregate during the winter and remain relatively sedentary on favored winter use areas through March (e.g., 150-500 acre home ranges). Winter use patterns across extensive CSTG winter ranges are not well established, owing largely to the difficulty in accessing and locating grouse at this time of year. Even where winter habitat is abundant and widely distributed, birds do not necessarily use winter habitat near the lek. Nearly 70 percent of 148 grouse tracked to wintering areas in northwestern Colorado moved greater than 4.4 miles from their lek of capture.

CSTG begin to depart wintering areas and start attending leks by early March. Nest construction and initiation of laying begins in early to mid-May, with incubation starting in mid- to late May, and hatching occurring in mid-to late June. Spring and summer movements of CSTG are usually restricted to within a 1.2 mi (2 km) radius around the lek site. Eighty to ninety percent of females nest and raise their broods within 1.2 mi of the lek where they were bred and suggests that females select nest sites in close proximity to suitable brood habitat. Dispersal of the remaining complement of hens tends to be expansive (i.e., up to 13.6 miles from the lek). CSTG typically select grass-low shrub (<3 feet tall) dominated communities during spring, summer, and fall, but they demonstrate considerable tolerance for varying shrub composition in habitat that serves nesting and brood-rearing functions. CSTG use grasslands with little or no shrubs as well as shrubland types with up to 40 percent shrub cover. The key factor is the amount of vegetative cover rather than species composition. The availability of permanent and seasonal wetlands and riparian areas on nest and brood ranges offer a richer and more abundant plant and invertebrate forage base favored by broods and important for brood survival and recruitment. Deciduous shrub and aspen stands in close proximity (e.g., 300 or more feet) of these specialized communities are considered especially important cover components of brood habitat. The nearest mapped production areas (i.e., nesting and brood-rearing habitat) are located 0.6 mile and 1.75 miles from the nearest boundary of lease parcel 7429 and 7416, respectively. Lease parcel 7416 appears to possess little, if any, potential to support spring-fall use by CSTG. Lease parcel 7429 encompasses grassland and open mixed shrub communities that are ostensibly suited for nesting and brood-rearing functions and are integral with dissected belt of shrubland habitat that connects two mapped production areas (i.e., southwest flank of Brush Mountain bordering Slater Creek).

See the Migratory Bird section for discussions pertaining to BLM-sensitive Brewer's sparrow, the Aquatic Wildlife section for discussion of BLM-sensitive fish and amphibians, and Terrestrial Wildlife section for discussions pertaining to northern goshawk.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

There is no reasonable likelihood of lease development causing direct impacts to the Yampa River and its endangered fish populations (see Aquatic Habitat section for overview of fisheries-related effects and impact controls). However, cumulative water depletions from the upper Colorado River Basin are considered likely to jeopardize the continued existence of all four endangered Colorado River fishes, including the Colorado pikeminnow, humpback chub, bonytail, and razorback sucker, and would result in the destruction or adverse modification of their critical habitat. In 2008, BLM prepared a Programmatic Biological Assessment (PBA) that addressed water depleting activities associated with BLM's fluid minerals program in the Colorado River Basin in Colorado, including water used for well drilling, hydrostatic testing of

pipelines and dust abatement on roads. In response, the USFWS (US Fish and Wildlife Service) prepared a Programmatic Biological Opinion (PBO) that addressed water depletions associated with fluid minerals development on BLM lands. The PBO included reasonable and prudent alternatives which allowed BLM to authorize oil and gas wells that result in water depletions while avoiding the likelihood of jeopardy to the endangered fishes and avoiding destruction or adverse modification of their critical habitat. The reasonable and prudent alternative authorized BLM to solicit a one-time contribution to the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (Recovery Program) in an amount based on the average annual acre-feet depleted by fluid minerals activities on BLM lands. Development associated with this lease sale would be covered by this agreement and water use would be entered into the LSFO water depletion log that is submitted to the BLM Colorado State Office at the end of each fiscal year. Under the current PBO, annual water depletion attributable to fluid mineral development in LSFO was projected to involve an average 369 acre-feet over the 15-year period from 2009 to 2023. At this level of fluid mineral-related water use, the augmentation protocol established separately for the Yampa River Basin would be expected to meet established base flow recommendations during base flow periods. From 2009 to 2015, depletions attributable to fluid mineral development in the LSFO have averaged 30.7 acre-feet per year. Water used in the potential development of this lease would contribute to the LSFO average annual total, but that average would not be allowed to exceed 369 acre-feet without further BLM and FWS analysis and section 7 consultation.

Both lease tracts represent potential winter use habitats for CSGT, where deciduous trees and shrubs would provide sole sustenance for wintering flocks of birds. Insufficient availability of deciduous shrubs, a limiting factor for CSTG throughout much of their continental range, is not an issue in northwest Colorado or the project area. Mountain shrub communities are widely distributed and comprise about 23% of the landscape within the current range of CSTG in Colorado. Deciduous and mixed shrublands are estimated to comprise about 57% of lands offered for Lease Parcel 7429 and 95% of lands offered for Lease Parcel 7416. With no effort extended to minimize or avoid the clearing or occupation of shrub stands suitable as winter habitat for CSTG, projected involvement (i.e., proportional to availability) would be limited to about 5 percent or less of the type (see section 3.4.2.2, Migratory Birds, Environmental Consequences). It is unknown at this time whether serviceberry, chokecherry, and aspen stands within the lease tract serve consistently as winter habitat for CSGT.

Up to half of lease parcel 7429 (~300 acres) is composed of mixed shrub, wetland, and meadow-types that may have potential to support CSTG nesting and brood-rearing functions. Half of that acreage (~135 acres), located along the benches of Slater Creek (the southern quarter of the lease tract), is subject to the terms of an NSO that is designed to protect perennial streams from development-related effects. Although bisected by Routt County Road 82, this sagebrush dominated corridor provides for relatively uninterrupted continuity of suitable spring-fall shrubland habitats across the breadth of the lease tract. Much of the remaining shrubland habitats along the lease's eastern (73 acres) and northern (54 acres) perimeter are variously dissected by forest (aspen) types.

Influences of oil and gas development on CSTG and their habitat, both from an individual and population perspective, is a relatively recent issue that is not well investigated, although the short

term impacts associated with direct habitat loss and behavioral avoidance are likely to mirror the implications that have been cited for greater sage-grouse, namely development activity and its infrastructure may exert adverse influences on grouse behavior and demographics miles from the source of disturbance, prompting declines in lek persistence and male attendance, yearling and adult hen survival, and nest initiation rates and elicit strong avoidance response in yearling age classes, nesting/brooding hens, and wintering birds.

CSTG have shown more generalized tolerance in using reclaimed energy mineral-related surface disturbance expressed as well-developed herbaceous-dominated ground cover for nesting and brood-rearing functions. Consistent with their considerable tolerance for varying shrubland composition in habitat that serves nesting and brood-rearing functions, CSTG have responded positively to coal mine reclamation in northwest Colorado and select these habitats disproportionately for breeding, nesting, and brood rearing. Reclaimed mine lands account for about 1% of the area associated with the Northwest Colorado Conservation Plan (Hoffman et al., 2007), but support about 18% of the active leks. Although coal mining and associated activities are acknowledged to remove seasonal shrubland habitats and displace CSTG in the short-term, subsequent reclamation composed of well-developed native and non-native grass/forb dominated communities regularly elevates or creates habitat conditions that attract and sustain important spring, summer, and fall CSTG reproductive use.

It has been noted that as long as suitable habitat remains available, sharp-tailed grouse appear to tolerate human disturbance better than other prairie grouse (Hoffman et al. 2015). The response of CSTG to coal mining activities in NW CO also suggests that CSTG tolerate predictable disturbances and may not prompt displacement from affected habitats to the same degree as that indicated for greater sage-grouse. CSTG leks have persisted on reclaimed lands within 0.5 mi of active mining operations and within 0.25 mi of major haul roads. Because the lands are entirely private, road upgrades attributable to fluid mineral development are not expected to elevate vehicle use associated with other land use activity, such as recreation.

Particularly on split-estate lands where subsequent land use remains the prerogative of the surface owner, BLM focuses its management attention on reducing behavioral impacts and long-term habitat loss attributable to oil and gas development. At a minimum, traditional management considered effective for maintaining CSTG populations by CPW involves reducing disruptive influences on important winter use areas (i.e., application of timing limitation LS-104) and minimizing the loss of important deciduous browse and aspen forage sources (e.g., siting adjustments negotiated with operator to reduce involvement of important foraging habitat).

Development's influence on these ranges would be contingent on the unpredictable geographic relationship of development to important grouse habitat and use functions. The risk of high levels of adverse behavioral effects would increase as a function of the number of pads or wells developed on federal estate and would be most pronounced under circumstances where affected habitat supports concentrated winter use or potential nest and brood activities. Relative to conventional vertical well developments, directional and horizontal drilling technologies that are now more commonly employed provide opportunities for significant reductions in well pad density and surface acres occupied through time. Depending on topography and lease

configuration, the increasing lateral reach of modern drilling techniques often increase flexibility in siting facilities to avoid or minimize the involvement of important surface resources.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

Development of these leases would represent incremental additions to the extent and intensity of oil and gas development activity and modification of shrubland and woodland habitats important in the support of CSTG, but these leases occur in areas where development intensity is relatively light or localized and at the present time would not be expected to add substantially to basin-wide habitat losses or population-level effects. Water depletions attributable to oil and gas development contribute cumulatively to the deterioration of critical habitat for the endangered Colorado River fishes, but these effects have been evaluated and appropriately mitigated by BLM through programmatic consultation and ongoing oversight with the FWS.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs and COAs to protect special status animals would be analyzed and added at the APD stage, as appropriate. APD-level analysis may include, but not be limited to, the following examples of COAs:

Adopt and apply management, stipulations, COAs, and BMPs specific to CSTG, or where lacking, those that have been developed for greater sage-grouse in NW Colorado as surrogate for CSTG until management-related information is better refined.

Avoid reduction of deciduous browse extent, especially serviceberry and chokecherry as a winter forage base for CSTG unless site-specific information on winter distribution on the lease tract contradicts such need.

Conduct CSTG lek surveys prior to feature/infrastructure siting. In the event a CSTG lek is documented, apply the LSFO-approved CSTG lek NSO stipulation (as a COA) within 0.6 mile of the lek and the nesting timing limitation (as a COA) within 1.25 miles of the lek. Lek surveys must be conducted consistent with CPW-approved protocols.

Avoid disturbance and occupation of potential CSTG nest and brood habitat (e.g., sagebrush, mixed brush, wetland, and grassland) until spring-fall occupancy status can be established from lek surveys.

Avoid vegetation manipulation or disturbance that results in the deleterious alteration of deciduous tree and shrub cover within 300 feet of streams, including intermittent and seasonally dry tributary drainages and wetlands.

Interim reclamation should be oriented toward herbaceous components and growth development most favorable to CSTG consistent with prerogative of the landowner.

Vegetation clearing, fill emplacement, or soil excavation that would adversely alter the hydrology of perennial, intermittent, or seasonal wetlands would not be allowed consistent with the prerogative of the landowner. Fluid containment systems should effectively isolate produced and flowback water from entering surface waters or ground water systems that contribute to surface water systems (e.g., close loop containment systems).

Adverse long term impacts to CSTG seasonal habitat values would be subject to operator-funded off-site mitigation that compensates for such impacts at a temporal and spatial scale commensurate with direct and indirect habitat loss as determined by BLM in coordination with CPW.

3.4.2.4 Upland Vegetation

Affected Environment:

Since parcel 7416 and 7429 are both located on private surface, the condition of upland vegetation would not be known unless a field visit was conducted. The range sites potentially affected by the proposed lease sale are deciduous oak (7416) and aspen forest and subalpine meadow (7429).

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

The act of leasing proposed parcels would have no impact on vegetation. Actual impacts of development activities cannot be predicted with certainty at the leasing stage. The impacts would be similar, but effects would vary by plant community. Generally oil and gas development involves complete removal of vegetation and at times re-contouring of the landscape. Vegetation removal would be commensurate with the level of oil and gas development in a given area. The type of ground-disturbing activity associated with oil and gas development results in increased susceptibility to adverse impacts such as weed infestations and erosion (See Invasive, Non-Native Species and Soils sections).

Direct impacts of vegetation removal include short-term loss of vegetation and the modification of plant community structure, species composition, and a short-term reduction of basal and aerial vegetative cover. Removal of vegetation also results in increased soil exposure, short-term loss of wildlife habitat, reduced plant diversity, and loss of forage. Indirect impacts include the increased potential for non-native/noxious plant establishment and introduction, accelerated wind and water erosion, changes in water runoff due to road/facility construction, soil impacts that affect plant growth (soil erosion or siltation), shifts in species composition and/or changes in vegetative density away from desirable conditions, and changes in visual aesthetics.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

Future oil and gas development on the proposed lease sale parcels would disturb soils and vegetation beyond past and present disturbances. Most vegetation loss would be for a relatively short timeframe because successful interim and final reclamation would help return desirable vegetation and ecological function to disturbed sites. Where plant communities are dominated by invasive annuals or noxious weeds, successful reclamation of those disturbances would likely improve the condition of the plant community.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect upland vegetation would be analyzed and added at the APD stage, as appropriate.

3.4.2.5 Wetlands and Riparian Zones

Affected Environment:

There are no riparian communities within the boundaries of lease parcel 7416. The nearest riparian vegetation is located about one mile downstream of the lease's eastern edge in Deal Gulch. Flow in the narrow valley is intermittently confined to a deep incise or overland across an unchannelized valley floor. Riparian expression is largely relegated to a narrow (e.g., 2 to 3 foot wide) band in the incise bottoms, but occasionally broadens (e.g., 12-20 feet) behind historic sediment-filled reservoirs. This riparian vegetation extends downstream for about 1.6 miles to the historic Williams Fork floodplain and involves about 3.5 total acres. Particularly along its lower reaches, and based on NAIP 2013 imagery, there are indications that community composition is largely facultative due to concentrated summer or fall livestock use. All lands and channels potentially influenced by lease development are privately owned.

Slater Creek, which skirts the southern boundary of 7429, supports a broad woody-dominated riparian community that includes dense stands of willow and gallery forests that involve narrow-leaf cottonwood, aspen, and/or box elder. The majority of this community lies outside the lease boundaries, but about 4 acres extend into the lease's extreme southern margin.

Seasonal wetlands on the terraces above Slater Creek involve about 13 total acres represented by about 20 individual sites ranging in size from 0.1 to 2.2 acres. The majority of these ephemeral and intermittent wetlands are dispersed in an approximate 0.25 mile arc along the northern perimeter of aspen woodlands in the center of the lease tract. These wetlands comprise about two percent of the lease tract and are presumed to support a mixture of facultative and obligate herbaceous vegetation, depending on the persistence of seasonal moisture and influences of ungulate grazing use.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

The influence of fluid mineral leasing on riparian resources would closely parallel that discussed in the Aquatic Wildlife section. The most common contaminant generated by oil and gas development that has the greatest potential to affect riparian vegetation is the release and off-lease transport of soil sediments from earthwork and roads attending lease development. Sediments that eventually reach perennial or intermittent channel systems that support riparian or wetland vegetation have the cumulative potential to exceed the capacity of a system to efficiently transport or incorporate sediments and prompt lateral and vertical instabilities in the channel and its banks as substrate for riparian/wetland communities. Sediment control standards have undergone substantial upgrade and are now routinely integrated with fluid mineral development authorizations as required through COGCC and CDPHE regulations. Mandatory implementation of COGCC/CDPHE stormwater regulations and BLM Onshore Orders and Gold Book standards are expected to limit fugitive sediment attributable to oil and gas development to levels undetectable from background, making it unlikely that sediment loading sufficient to degrade downstream channel systems would be generated by development of these leases.

In a similar vein, and as discussed in the Aquatic Habitat section, unintentional releases of oil, condensate, or produced water from pipelines or well pads that eventually enter perennial or intermittent systems would have the potential to temporarily affect all components of downstream riparian and aquatic communities. Considering elevated attention to storm-water management practices and low historical incidence of damaging events (e.g., reportable events in COGCC records), the probability of inadvertent off-pad release of toxic substances capable of

adversely affecting aquatic communities in Slater Creek and the Williams Fork River is considered low.

The 7416 lease tract is initially separated from the nearest riparian vegetation by one mile of unchannelized valley bottom and several small intervening in-channel stock ponds. This circumstance would sharply limit the likelihood of contaminants reaching the subtending 1.6 miles of Deal Gulch that support riparian vegetation. Furthermore, that 1.6 mile reach is also interrupted by several in-channel dams prior to emptying across 700 feet of unchannelized alluvial terrace prior to its juncture with the Williams Fork River. Under this set of physical and regulatory circumstances, the risk of measurable levels of contaminants directly entering the Williams Fork River is considered remote.

The Little Snake RMP provides for an oil and gas lease stipulation (NSO) that prohibits surface occupancy that may adversely influence water-related resources up to 0.25 mile from perennial water sources; this provision would apply to Slater Creek (lease tract 7429) and, as discussed more fully in the Aquatic Habitat section, would work with other regulatory and RMP-derived management measures in preventing any substantive direct or indirect impacts to the channel or associated riparian vegetation. Seasonal wetlands and ponds dispersed across this lease outside this NSO buffer comprise about three percent of the lease acreage. Owing to their small size and dispersed, discontinuous distribution, avoidance measures developed at the APD stage (i.e., up to 200-meter siting adjustments negotiated during on-sites) would be effective in providing physical and functional separation sufficient to prevent adverse direct or indirect influences on these sites and systems.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

As conditioned by NSO stipulation and presuming seasonal wetlands are successfully avoided through site-specific COAs, there is little likelihood that lease development would involve substantive physical impact to riparian or wetland communities, and would therefore not contribute to their loss in a cumulative context. The current suite of State (i.e., COGCC and CDPHE) and federal regulatory processes regulating off-site sediment and contaminant delivery are expected to remain effective in preventing oil and gas development from impairing riparian/wetland communities and would reduce to discountable levels the likelihood that development and operation of oil and gas facilities on these leases would contribute cumulatively to sediment or chemical contaminants deleterious to the support and maintenance of on-site or downstream riparian communities in Deal Gulch, the Williams Fork River, and Slater Creek and its associated wetlands.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect wetland and riparian zones would be analyzed and added at the APD stage, as appropriate.

3.4.2.6 Aquatic Wildlife

Affected Environment:

For Parcel 7416, the William's Fork River above Hamilton is known to support a number of native fish regarded as BLM-sensitive, including: roundtail chub, bluehead sucker, flannelmouth

sucker, mountain sucker, and Colorado River cutthroat trout. Parcel 7416 is initially separated from contributing channels (i.e., Deal Gulch) by one mile of unchannelized valley bottom with several small intervening stock ponds, much of which appears to have been formerly cultivated agricultural lands. The subtending 1.6 miles of Deal Gulch is represented by a small, intermittent channel that is alternately incised and overland, and interrupted by several in-channel dams. This channel eventually empties across 700 feet of unchannelized alluvial terrace that has been strongly modified for agricultural use.

The mainstem of Slater Creek skirts the southern margin of Parcel 7429, crossing the extreme southwest corner of the lease tract for about 600 feet. Fish distribution in this reach of Slater Creek is composed primarily of native speckled dace, but downstream reaches and tributaries are known to support BLM-sensitive bluehead sucker and Colorado River cutthroat trout (CRCT). With the exception of speckled dace, native fish distribution is thought to terminate at a falls about 0.5 mile upstream of that reach encompassed by the parcel; brook trout occupy the reach above the falls. The nearest identified population of CRCT is located in South Fork Slater Creek, a tributary of Slater Creek which empties to the mainstem about 4,600 feet downstream of the lease tract. Further downstream, the Roaring Fork of Slater Creek and Cataract Creek, also support CRCT populations. Mainstem Slater Creek is not known to be occupied by CRCT and does not presently interconnect these populations. Terminating at the falls that forms a barrier to upstream passage, CPW has identified the reach bordering the southwest quarter of the lease tract and extending downstream to the confluence with Cataract Creek as CRCT Expansion Habitat (i.e., important for population recovery).

It is likely that both Slater Creek and the Williams Fork River support populations of BLM-sensitive northern leopard frog, as well.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

Increased levels of development attributable to these leases has potential to contribute incrementally to declines in fish or amphibian abundance or habitat degradation caused primarily through indirect means, such as sediments liberated from road, pad, and pipeline construction, inadvertent introduction of contamination of surface waters with invasive aquatic plants and aquatic pathogens/parasites during water handling procedures, and accidental release of contaminants (e.g., produced water or petroleum products). Excess sediment and contaminants can contribute to adverse changes in water quality and/or prompt system changes that can lead to mortality in aquatic vertebrates through disease and acute or chronic toxicity, compromising the food base, or destabilizing streamside riparian or channel features important in the support of aquatic communities (e.g., smothering of spawning beds, lateral channel erosion caused by excessive sediment deposition).

As the most common contaminant generated by oil and gas development, the release and off-lease transport of soil sediments from earthwork and roads attending lease development would be inevitable. Sediments that eventually reach perennial or intermittent systems that support riparian or wetland vegetation have the cumulative potential to exceed the capacity of a system to efficiently transport or incorporate sediments and prompt lateral and vertical instabilities in the channel and its banks as substrate for riparian/wetland and aquatic communities. Sediment control standards have undergone substantial upgrade and are now routinely integrated with fluid

mineral development authorizations as required through COGCC and CDPHE regulations. Mandatory implementation of COGCC/CDPHE stormwater regulations and BLM On Shore Orders and Gold Book standards are expected to limit fugitive sediment attributable to oil and gas development to rates that would be undetectable from background levels, making it unlikely that sediment loading sufficient to degrade downstream aquatic habitats would be generated by development of these leases.

Unintentional releases of oil, condensate, or produced water from pipelines or well pads that eventually enter perennial or intermittent systems would have the potential to adversely affect all components of downstream aquatic communities. Considering elevated attention to storm-water management practices and low historical incidence of damaging events (i.e., reportable events in COGCC records), the probability of inadvertent off-pad release of toxic substances capable of adversely affecting aquatic communities in Slater Creek and the Williams Fork River is considered low. BLM has regional hazard materials response plans to deal with oil and gas leaks and oil and gas companies have contingency plans in place regarding leaks or spills. Lease development activity would generally be well removed (e.g., intervening ephemeral or intermittent channels) from systems supporting higher order aquatic communities, but would involve the potential for indirect effects arising from off-lease transport of sediment and contaminants and flow depletion.

Parcel 7416 is separated from the Williams Fork River by over 2.7 miles of ephemeral and intermittent channels, overland drainage, and in-channel stock ponds. This circumstance would be expected to substantially reduce the risk of contaminant access to the river considering the attention paid to off-site sediment transport and response to contaminant release events presently employed through State and federal stormwater, fluid management, and reclamation measures.

The Little Snake RMP provides for a NSO stipulation (LS-105) that prohibits surface occupancy that may adversely influence water-related resources up to 0.25 mile from perennial water sources; this provision would apply to Slater Creek (Parcel 7429). NSO application can be modified depending on the type and use of the water source, soil type, and slope steepness and would be evaluated on a project-specific basis in the context of CRCT recovery.

Seasonal wetlands and ponds dispersed across Parcel 7429 outside this NSO buffer comprise about three percent of the lease acreage. Owing to their small size and dispersed, discontinuous distribution, avoidance measures developed at the APD stage (i.e., up to 200-meter siting adjustments negotiated during on-sites) would be effective in providing physical and functional separation sufficient to prevent adverse direct or indirect influences on these sites and systems. Vehicle routes previously established across the parcel may provide a practical template for development-related access.

In addition, fluid mineral development that has potential to influence aquatic habitat that supports or contributes to Conservation Populations of CRCT would be expressly analyzed and, when necessary, mitigated before project implementation (page D-4 of the Little Snake RMP ROD). Project-specific development of COAs that would minimize the risk of contaminant entry into Slater Creek is consistent with CRCT recovery efforts and CPW's identification of

Slater Creek (i.e., below the falls, including that reach within the lease tract) as CRCT Expansion Habitat.

In summary, siting and reclamation considerations provided through the perennial water NSO stipulation LS-105, complementary riparian and aquatic habitat avoidance and mitigation measures afforded by BLM policy and current Little Snake RMP decisions, and the suite of State and federally-imposed design and operational measures designed to control erosion and spills, are expected to be fully capable of reducing projected federal oil and gas development effects to discountable levels with respect to downstream fish and amphibian habitats.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

In both leasing situations, BLM-administered lands are not extensive or strategic in the support of aquatic systems associated with the Williams Fork River or Slater Creek, but development of the federal fluid mineral estate would be expected to contribute incrementally to cumulative system-wide influences attributable to non-federal mineral, agricultural, or recreation activities.

Imposed lease stipulations, site-specific development of COAs at the APD stage designed to avoid or mitigate direct and indirect impacts on water-borne resources, and the current suite of State (i.e., COGCC and CDPHE) and federal regulatory processes regulating off-site sediment and contaminant delivery are expected to remain effective in preventing oil and gas development from impairing downstream aquatic habitats and reducing to discountable levels the likelihood that development and operation of oil and gas facilities on these leases would contribute cumulatively to sediment or chemical contaminants acutely or chronically deleterious to the support and maintenance of aquatic communities in Slater Creek or the Williams Fork River.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect aquatic wildlife would be analyzed and added at the APD stage, as appropriate. APD-level analysis may include, but not be limited to, the following examples of COAs:

To reduce the risk of inadvertent introduction and contamination of area streams with invasive aquatic plants and animals and aquatic pathogens/parasites, any equipment to be used for lease development that comes in contact with waters that contribute to or directly involve occupied aquatic habitats must comply with the most current disinfection practices endorsed by Colorado Parks and Wildlife.

As a means of reducing the risk of physical disruption and sediment-related effects on fish reproduction and spawning habitat (e.g., smothering of eggs, fungal exposure), timing limitations will be applied, as appropriate, to authorizations that involve channel feature disturbances or sediment release to occupied habitats during species-specific incubation timeframes recommended by Colorado Parks and Wildlife (i.e., collectively between March 15 and September 1).

Establish a surface water monitoring system and monitoring protocol capable of detecting changes in stream chemistry and contaminants attributable to fluid mineral development that pose a risk to aquatic systems in Slater Creek and the William's Fork River.

3.4.2.7 Terrestrial Wildlife

Affected Environment:

Parcel 7416 is associated with extensive big game seasonal ranges in Game Management Unit 13 associated with elk Data Analysis Unit E-6 and deer Data Analysis Unit D-7. These mid-elevation mixed shrub ranges, at elevations of 7000-7600 feet, are used predominantly by deer and elk as summer range and are more specifically used by elk for the birthing and rearing of calves (i.e., mapped production area) used primarily from April 16 to June 30. However, the lease parcel also supports concentrated winter use by elk at animal densities double that of surrounding winter ranges (i.e., winter concentration area). Use of these winter ranges is most prevalent from December 1 to April 30.

A small cliff series at the mouth of an unnamed tributary of Deal Gulch has supported small stick nests in the past (likely red-tailed hawk) and there is a reasonable likelihood that red-tailed hawks or golden eagles continue to use this rock outcrop. Cliff-nesting raptors can begin nesting in early February (e.g., golden eagle) and generally fledge young by mid-August.

Lease parcel 7429 is entrenched in extensive higher elevation (7640-8800') big game summer ranges associated with elk Data Analysis Unit E-2 and deer Data Analysis Unit D-2. Both species tend to occupy these ranges from mid-April through November. These southwest trending aspen and mountain shrub benches are interspersed with seasonal and perennial wetlands and represent favored big game summer habitats. Accordingly, CPW has conferred special management attention on those elk ranges associated with lease 7429 due to its function as a production area (i.e., birthing and rearing of calves, primarily April 16 to June 30) and its support of elk populations double that of surrounding ranges (i.e., summer concentration area). These area-specific values were instrumental in CPW pursuing long-term Conservation Easements with this and adjoining landowners, and this lease parcel is integral with the 3,000-acre Brush Mountain Ranch Conservation Easement. The lease parcel itself comprises roughly 1% of the elk summer concentration area mapped in the northwestern quarter of DAU E-2.

Parcel 7429 is composed entirely of private lands that abut the Routt National Forest on its southern boundary. Although a rather extensive two-track and trail network has been developed on these lands (minimum 3 miles), with the exception of Routt County Road 82 (1.2 miles) traversing the lease east to west, access is privately controlled and the routes appear to receive infrequent, low volume use in support of ongoing land use (e.g., grazing, logging, big game hunting).

The parcel encompasses about 260 acres of relatively continuous aspen woodland, 40-50 percent of which was logged about 20 years ago. Mature woodlands are now distributed in narrow serpentine configurations that are generally less than 100 meters wide. Although it is possible that woodland raptors continue to use mature components as nesting and foraging substrate (e.g., sharp-shinned, Cooper's hawk, northern goshawk, red-tailed hawk, flammulated owl), intervening blocks of dense regenerating aspen canopies reduce the availability of suitable foraging habitat such that raptor nest activity would remain substantially reduced until more

mature aspen structure is regained over ensuing decades. Raptors associated with these woodlands generally initiate nest activities by early April and fledge young by mid-August.

Greater sandhill cranes, a CPW Species of Special Concern, are known to nest on the aspen-shrubland benches associated with Parcel 7429. Sandhill cranes nest in exposed positions in close association with the area's more persistent wetlands. Breeding birds arrive in northwest Colorado by mid-March and after a 2-4 week nest initiation period and 4 weeks of incubation, young birds hatch by early June. Young birds are brooded through June and during this time generally remain within about 700 feet of the nest site. Young fledge by late July, but tend to remain in the vicinity of selected nest habitat through September.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts: Shrubland and woodland clearing and facility occupation attributable to lease development would result in longer term modification or loss of woody vegetation as a source of wildlife forage or cover that would persist from 15 to 30 years post-reclamation in mixed shrublands to 75 or more years in aspen and Gambel oak-dominated shrublands. Interim (pad) and final (pipeline) reclamation applied to surface disturbances would not generally be expected to regain useful shrubland character over the life of the well, but would be capable of serving as a source of herbaceous forage and cover in the short term.

Particularly at the levels of vegetation modification and surface occupation likely to accompany lease development, it is unlikely that direct habitat loss or long term modification would exert strong influences on big game populations. However, indirect influences attributable to animal avoidance and disuse of suitable habitat adjacent to development activity are likely to be more extensive and influential over the life of the lease. Recent work from Wyoming suggests that avoidance and disuse of habitat associated with winter drilling activity in open shrubland communities is at least 2 orders of magnitude greater (e.g., 400 versus 4) than direct habitat loss (Sawyer et al. 2009a).

Demonstrated widely for big game since the 1970's (Rost and Bailey 1979) and more precisely defined with GPS technology (e.g., Preisler et al. 2006) is the tendency for animals to avoid human disturbance, which is most commonly associated with the use of access roads and trails. Vehicle traffic that supports well development and production is thought to represent the most broadly influential component of oil and gas activity in northwest Colorado. Road-related effects on wildlife vary as a function of frequency and duration of use and the density of the road network across affected habitats. The influence of vehicle use associated fluid mineral development on these leases would be governed by the location and density of pads and roads, and the fluid transport mode during production. Pertinent to the issue of long-term avoidance response, these leases are composed entirely of privately-controlled surface, which would be expected to substantially moderate the persistence and intensity of big game avoidance once construction and well development were complete. In the absence of unregulated public use, access roads constructed or upgraded for development would receive low frequency use of a more predictable nature and would be expected to have declining influence on big game range utility during the subsequent decades-long production phase (Webb et al., 2011).

The distance at which big game consistently react (e.g., flight, avoidance, elevated alert) to human and vehicular activity has been variously reported from a minimum of about 330 feet to 2,600 feet and more depending on the species, cover, and the nature of the disturbance (Rost and Bailey 1979, Taylor and Knight 2003; Ward 1986), but generally does not fall below 660 feet. Sawyer (2009a) demonstrated that most (70 to 85 percent) mule deer wintering in open Wyoming shrubland tended to select areas away from natural gas pads in a developing field. In this study, areas with the highest probability of use were approximately 2 miles from natural gas pads. Over the course of 7 years, deer demonstrated no habituation, but rather selected habitats increasingly further from well pads as development progressed. Elk have been shown to display similar avoidance response to oil and gas development. Radio collared elk in the Jack Morrow Hills, Wyoming demonstrated avoidance of active well sites and access roads by distances of 0.6 mile in winter and 1.25 miles in summer (Powell 2003).

Avoidance of human activity, regardless of form, has important ramifications on big game energetics (e.g., avoidance movements, heightened state of alert) (Geist 1978) and nutrition (e.g., reduced time foraging and access to available forage, displacement from preferred foraging sites that, in turn, have consequences on fitness and performance (e.g., survival, reproduction) at the individual and population level). As effective forage availability becomes increasingly constrained by removal or avoidance response, and animal use is incrementally relegated to smaller proportions of more optimal seasonal range, it is inevitable that the capacity of the range to support former numbers of animals would deteriorate, and eventually increase the probability of density-dependent adjustments in animal abundance. Bartmann et al. (1992) demonstrated strong nutritionally-driven density-dependent winter mortality in mule deer. Wintering mule deer populations subject to the influences of natural gas development in Wyoming declined 30 percent while unaffected portions of the herd declined 10 percent (Sawyer 2009b).

While big game are contending with the seasonal challenges (e.g., declining quality and access to forage in winter) and elevated energy demands of winter (e.g., maintaining homeothermy, reducing energy expenditures to extend fat stores, gestation) and summer (e.g., winter recovery, lactation), human disturbance and displacement to unfamiliar grounds divert from time and energy that would otherwise be expended in more efficient procurement of forage and managing energy expenditures (e.g., reducing heat loss, reducing travel across steep slopes or heavy snowpack). It would follow that extraneous energetic demands placed on big game, particularly during late gestation, lactation, and the winter season may contribute to chronically suppressed reproductive performance, recruitment, or animal fitness that, at expansive scales, could manifest population-level effects (Sawyer 2009b).

As a means of reducing the manifestations of big game avoidance response on those seasonal ranges considered most important in the support of affected deer and elk populations, RMP-authorized timing limitation stipulations LS-101 and LS-115 would be applied to winter concentration areas and elk production areas during the core periods of occupation. Timing limitations, by eliminating more intensive forms of development activity during the period of occupation, are capable of substantially reducing animal avoidance of oil and gas pads (e.g., 45-65% in winter) (Sawyer et al. 2009a; Sawyer et al. 2009b).

Cliff-nesting raptors, such as those associated with the 7416 lease parcel, are not normally subject to actions that adversely alter nest substrate, but nesting efforts remain susceptible to development-caused disturbances (e.g., pad or access development within a nominal 0.25 mile of ongoing nest activity) that lead to absences of adult birds sufficient to jeopardize egg or nestling survival from malnourishment, exposure, or predation.

Habitat-related risk attending fluid minerals development of the 7429 lease parcel would extend primarily to woodland nesting species (i.e., accipiters, owls) where the clearing of aspen woodlands can alter nest stand conformation or the character of the surrounding habitat for decades. However, the distribution and extent of mature aspen woodlands as raptor nest habitat was significantly altered by aspen harvest in Parcel 7429 (~mid 1990s). Relative to that scale of modification, clearing of mature aspen attributable to fluid mineral development may be several decades longer in duration, but much smaller in scale. Considering the expanse of aspen available to raptors in the general project vicinity, it is unlikely that nest habitat influenced by lease development would have measurable influence on the abundance or distribution of nesting raptors at any scale larger than the lease tract.

Raptor nest surveys would be required prior to project implementation in those areas potentially influenced by proposed development activities. Information on functional nest sites found in the course of survey are used as the basis for developing siting alternatives or applying timing limitations that reduce the risk of nest activity disruptions that could result in reproductive failure or compromise the long-term utility of nest habitat.

RMP-authorized NSO and Timing Limitation (TL) buffers applied as lease stipulations (LS-103 and LS-106) or COA are effective in maintaining the utility of nest habitat for subsequent nesting use and preventing disruption of ongoing nest efforts.

Greater sandhill cranes, with their tendency to establish nests in areas with full exposure, are particularly vulnerable to development-related disturbances that can lead to nest failure and chick mortality during nest initiation, incubation, and early brood periods when adults and young remain closely associated (within 200 meters) with the nest site. RMP-approved timing limitations (LS-117) have been established for this area to limit disruptive activities during nesting and staging periods. Project-specific surveys may be employed to refine the application of these timing limitations and consider siting options that would be less likely to preclude subsequent use of favored nesting habitat.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

Development of these leases would represent incremental additions to the extent and intensity of oil and gas development activity and modification of shrubland and woodland habitats in their respective basins, but in and of themselves these leases occur in areas where development intensity is light or localized and at the present time and as conditioned would not be expected to add substantially to basin-wide habitat losses or population-level effects.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect terrestrial wildlife would be analyzed and added at the APD stage, as appropriate. APD-level analysis may include, but not be limited to, the following examples of COAs:

Avoid or minimize the long term loss or adverse modification of effective cover types via vegetation clearing or infrastructure occupation.

Minimize the density and use-frequency of well access roads; avoid routine and schedulable activity to timeframes outside sensitive periods for big game and raptors.

Relevant especially to Parcel 7429: Vegetation clearing, fill emplacement, or soil excavation that would adversely alter the hydrology of perennial, intermittent, or seasonal wetlands would not be allowed, consistent with the prerogative of the landowner. Fluid containment systems should effectively isolate produced and flowback water from entering surface waters or ground water systems that contribute to surface water systems (e.g., close loop containment systems).

3.4.3 Heritage Resources and Human Environment

3.4.3.1 Cultural Resources

Affected Environment:

An examination of the Colorado Office of Archaeology and Historic Preservation's on-line data base, COMPASS (accessed 9/9/2015), indicates that there is no inventory data for Parcel 7416 and there are no known sites on the parcel. An examination of the database for an area including the sections immediately surrounding the parcel identified eight inventories (Breternitz 1972, Caraveo and Greet, 1980, Kainer 1984, Loscheider 1981, Mehal and Mehls 1991, Paschal 2009). The majority of the inventories are related to the nearby Trapper coal mine. One inventory is for a grazing allotment management plan for the United States Forest Service (Paschal 2009). The inventories identified three sites in the surrounding area, 5MF.948, 5MF.290, and 5MF.1960. Only site 5MF. 948 has been determined to be eligible for nomination to or listing on the National Register of Historic Places (NRHP) out of the three recorded sites. The terrain including the parcel and the surrounding area is very steep and rugged which seems to limit the areas available for human occupations. Rock shelters are found in the area which would likely have been used for shelter such as 5MF.290 which was officially determined to be ineligible for nomination to or listing on the National Register of Historic Places (NRHP). Site 5MF.1960 is a historic homestead that was used as part of the process of acquiring land for private ranching purposes. A search of the online patent records suggest the homestead was originally patented to Mr. Ezra Baylock under the 1862 Homestead Patent Act.

Parcel 7416 was patented to Mr. Jacob Hammil in 1966 as a direct sale pursuant to 38 stat. 509, 41 stat. 437 and 47 stat. 1570. A review of topographic maps and aerial photographs indicate that the majority of the parcel is extremely steep, likely exceeding the slope exclusions for inventory in BLM Manual 8110.23(B)(4) and the current 2014 Colorado Protocol. The parcel is also heavily vegetated (see above vegetation discussions) which suggest that resources might not be present on the steeper slopes.

The private lands encompassed by Parcel 7429 were originally patented under two separate patents, patent number 1041734 to Wesley Carter and patent number 1050419 to John P. Jamison. Both patents were under the Stock Raising Homestead Act of December 29, 1916 which reserved all of the mineral estate, including oil and gas, to the United States. The patents were issued in the 1930's. As a result of the early patent date and the fact that no federally funded or permitted activities have occurred on the properties there have been no archaeological inventories documented in the OAHP COMPASS online database. There are no cultural resources documented in the parcel according to the COMPASS base (accessed 9/9/2015).

A file search was conducted for the section the lease parcel is in and each adjoining section in the OAHP Compass online database (accessed 9/9/2015), which identified five inventories in the surrounding area (Bonnifield 1996, Keesling 1987, Overturf 1995, Paschal 1009, and Trook and Goot 2004). All but one of the inventories (Keesling 1987) were conducted by the Forest Service on the lands surrounding the lease parcel. These inventories identified four cultural resources that appear to be associated with sheep or livestock grazing on the forest. One site, 5RT.1833, has officially been determined to be ineligible for nomination to or listing on the NRHP. The remaining three sites, 5RT. 1835, 5RT.1836, and 5RT.1580 have been recommended as ineligible by the Forest Service staff archaeologists. The COMPASS database (accessed 9/9/2015) indicates that the Colorado SHPO has not made a formal determination on the Forest Service recommendations.

An examination of aerial photography and topographic maps on COMPASS indicates that the terrain is relatively gently sloped with what may be natural water impoundments. It is anticipated that the original homestead houses and other ranch features would be located on the parcels along with potential hearing camps or other historic period features. Prehistoric and Proto-historic features may also be found on the parcel.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

Leasing of Parcel 7416, in and of itself, does not have any direct impacts on any known cultural resources or potentially present resources in the parcel area. It is not possible to completely rule out the potential for resources on the parcel but, given the steep terrain the likelihood of resources being present is quite low. In the event that development were to occur on the parcel there is a very low probability for archaeological resources to be impacted and the areas most likely to contain resources might be in the alluvial areas of the drainage bottoms or the very tops of the ridges in the parcel. In those areas that are flat enough inventory prior to development might be possible though the dense vegetation might make identification of small lithic scatters or very short term camp sites extremely difficult. The scientific archaeological data such sites might contain is likely to be quite limited and may not contribute very much to the regional archaeological database.

Indirect impacts would likely be very limited, if there are any cultural resources present. Due to the dense vegetation and steep slopes over the majority of the parcel the potential for sites is low and the ability for increased human activity in the area to impact the resources is also likely quite limited. If erosion were to occur on any portions of the parcel due to poor surface use planning there is a very small potential to impact any resources that might be present. Impacts, should there be any, would be the loss of archaeological context as artifacts are washed down

slope. Any non-portable artifacts (features such as hearths) could be eroded away which could destroy any chronometric or environmental/environmental data that might have been present. Due to the limited potential for the presence of cultural resources in the parcel the loss of any scientific data from the archaeological database of Moffat county is likely to be minimal.

Direct impacts to culturaleal resources would depend on what resources, if any, are identified during project specific inventory and the desires of the private land holder(s) in consultation with the Colorado SHPO. The most severe impact could be the total destruction of a resource. A variety of lesser impacts could occur depending on the land use agreement between the private land holder(s) and the developer when drilling is proposed. Direct and indirect impacts could range form total destruction to various impacts such as loss of artifacts from collection and/or erosion, loss of features such as hearths, built features such as fences, corrals or other structures or total avoidance at the discretion of the owners. Applying lease stipulation CO-39 to the parcels requires operators follow archaeological laws and would limit disruption of cultural resources.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

In the event that development should be proposed for the parcels there is an unknown potential to cause cumulative impacts to cultural resources since the extent of resources in the area is unknown.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect cultural resources would be analyzed and added at the APD stage, as appropriate.

3.4.3.2 Hazardous or Solid Wastes

Affected Environment:

There are no known hazardous or other solid wastes on the proposed lease sale parcels. No hazardous waste generators, transporters, treaters, storers, or disposers have been reported to state environmental agencies on the proposed parcels. The closest hazardous waste reports are for Trapper Mine west of Parcel 7416, and local businesses in Craig CO for Parcel 7429 (Envirofacts).

Management of hazardous materials, substances, and waste (including storage, transportation, and spills) must be conducted in compliance with 29 CFR 1910 (Occupational Safety and Health Standards), 49 CFR 100-185 (Pipeline and Hazardous Materials Safety Administration, Department of Transportation), 40 CFR 100-400 (Protection of the Environment, U.S. Environmental Protection Agency), Comprehensive Environmental Response Compensation and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), Toxic Substances Control Act (TSCA), Clean Water Act (CWA), and other federal and state regulations and policies regarding hazardous materials management. In addition, CERCLA and RCRA exemptions could apply to waste by-products of oil well development and these waste streams would be managed accordingly.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

If exploration and development were to occur, operators would use of a variety of chemicals and other materials, some of which could be classified as hazardous under various authorities, including drilling muds and additives for completion and hydraulic fracturing activities. These materials could contain various contaminants such as salts, acids, mercury, cadmium, arsenic, and hydrocarbons, among others, which, if not managed correctly, could be released to the environment. Potential impacts associated with hazardous materials could include the potential for human contact by public users and occupational exposures (e.g. inhalation or ingestion), accidental fires, surface and groundwater contamination, and impacts to vegetation and wildlife. The potential for increased spills and leaks would be proportionate with the level and age of developments that were proposed on each of the leased parcels (e.g. higher development increases use of hazardous materials, and older equipment increases risk of equipment failure).

Spill identification, prevention, and counter measures implemented by operators during the oil and gas development process would minimize the amount and extent of a release, thereby limiting the extent of impacts. The management of the hazardous materials and solid wastes that are used, transported, stored and disposed in association with a project would be reviewed at the time of the APD and impacts would be addressed during the site specific analysis for each development proposal.

Oil and gas operations would, at a minimum, comply with applicable Onshore Orders, the Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development “The Gold Book” (BLM 2007), Notice to Lessees and Operators of Onshore Federal and Indian Oil and Gas Leases (NTL-3A), and applicable COGCC rules. In addition, management of waste in oil and gas operations would be managed in accordance with all Federal, State, and local regulations.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

Hazardous and solid wastes can be generated, transported, treated, stored, and disposed of through mining, recreational, installation of powerlines, pipelines, commercial activities and oil and gas development in the CIAA. Oil and gas exploration and development of these lease parcels would incrementally increase the likelihood of releases of hazardous and solid wastes. If mitigation measures are properly applied for this action, then future impacts would be limited.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect against hazardous or solid wastes would be analyzed and added at the APD stage, as appropriate.

3.4.3.3 Native American Religious Concerns

Affected Environment:

At the present time there are no known Native American concerns for the two parcels. The lack of prehistoric resources identified in the surrounding inventoried areas suggest that Native American use of the areas was very limited, likely transitory in nature and would not necessarily be conducive to places where sacred or culturally important sites would be expected.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

At the present time there are no known or expected direct or indirect impacts to any Native American Religious sites or settings within the two lease parcels. Upon the identification of particular well pad locations additional consultation would likely be required, particularly if any cultural remains that can be identified as Native American are identified during project specific inventory.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

There is a possibility to impact as yet unidentified areas of religious concern as a result of future lease development. If the Tribes who once occupied this area do identify areas of religious importance or significance the extent of loss of religious values would depend largely of the results of negotiations with all parties to see if project redesign can avoid those impacts. The loss of any areas of religious would likely result in a cumulative loss of the factures important in tribal heritage. The loss of values to the tribes would not be known unless or until those areas of religious significance are identified and evlatuated. The tribes may consider those losses to be cumulative and quite severe in regards to the heritage of the affected tribes.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect Native American religious concerns would be analyzed and added at the APD stage, as appropriate.

3.4.3.4 Paleontological Resources

Affected Environment:

Parcel 7416 is located in an area generally mapped as the Williams Fork Formation (Tweto 1979) which BLM has classified as a Potential Fossil Yield Classification (PFYC) 5 formation. In other areas of Colorado and the Northwest District the Williams Fork is known to produce scientifically noteworthy fossil resources, including dinosaurs.(c. Armstrong and Wolny 1989) and is rated as a PFYC 5 formation.

Parcel 7429 is located in an area that may include portions of the Fort Union and Lance formations (Tweto 1979). These formations do not currently have a PFYC classification in LSFO but are generally ranked as PFYC 3 for the Fort Union and PFYC 5 for the Lance Formation in northwest Colorado (c. Armstrong and Wolny 1989). A PFYC 3 formation classification indicates that the fossil producing potential for a particular formation in a given area may not be well known or explored. Fossils are not necessarily evenly distributed throughout a formation and some areas have the potential for produce more fossil remains than others. PFYC 3 formations generally need more investigation to understand their fossil producing characteristics. A PFYC 5 formation, on the other hand, is well known for producing many scientifically noteworthy fossil remains and while not distributed even through the formation fossil can often be found in a wide variety of locations in the formation.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

Leasing Parcel 7416 and 7429 would not necessarily result in any impacts to fossil resources as no ground disturbance is involved in simply issuing a lease.

The potential for impacts to fossil resources would come at the time the lease holder submits an APD and a Surface Use Plan of Operations (SUPO) that spells out the specifics of the proposed well pad, well pad access route and the methods for moving the product to market. The extent of impacts would depend on a number of variable such as the size of the proposed well pad, the length and width of any proposed access roads, the excavations of any proposed cuttings/reserve/blooiie pits and the lengy and width of any trenches for pipelines that might be used to transport the product to marker. On this parcel the impacts could be dependent on which of the formations the development activity is proposed to take place on.

Direct impacts would occur as a result of excavations into the underlying rock formation to construct the roads, pipelines and the well pad. Excavations could crush or fragment fossils and displace them from their environmental context. Erosion on inadequately or encomplete reclamaiton work could accelerate loss of fossil resources due to displacement and tumbling of smaller fossils or accelerated erosion and crumbling of larger exposed fossils. Exposure of previously buried fossil resources could result in increased surface collection of the newly exposed fossils.

The treatment of fossils discovered during development would be determined by the private surface owner in accordance with BLM policy and regulation.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

Simply issuing a lease would not result in any direct impacts to fossil resources. However, at the time of development there is a potential for direct and indirect impacts to fossil resources depending on the specifics of the surface use plan and the number of well pads proposed for the parcel. However, since the combined area of the parcels is approximately 837 acres out of a total field office area of over two million acres the percentage of area is vey small. The extent of the scientific impact would depend on the nature of the fossil resources impacted. Vertebrate fossils are relatively scarce in the fossil record, and as such are considered scientifically important. Some invertebrate or plant fossils may also be considered, on a case-by-case basis, to also be of scientific interest. In summary, there is a potential for a loss of scientific paleontological resources as a result of surface disturbance or excavations into the underlying rock formations.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect paleontological resources would be analyzed and added at the APD stage, as appropriate.

3.4.3.5 Social and Economic Conditions

Affected Environment:

Demographic, economic, and geographic features influence and define the nature of local economic and social activity. Among these features are the local population, the presence and proximity of cities or regional business centers, industrial organization, infrastructure, geography, and unique area amenities. The affected social and economic environment, the socioeconomic study area, is Moffat and Routt County, Colorado within LSFO.

Of the two counties in study area Routt County is more populous with a population of 23,513 as Moffat County has a population of 13,103 Both Moffat and Routt counties have high levels of employment in mining, retail, and government sectors where employment in these sectors totals 36% of total county employment in Moffat County and 21% of total county employment in Routt County, with Routt County also having high levels of employment in the recreation, construction, and real estate sectors. These counties are characteristic of Colorado’s economic dependence on natural resources and outdoor recreation as an economic base. Different regions in Colorado have varying economic dependence upon natural resource extraction which is highlighted by the State’s 1.5% of total employment in the mining sector (the mining sector includes oil and gas industries). Both Moffat County and Routt County have greater levels of employment in the mining sector than the State average with 8.6% of total county employment in the mining sector in Moffat and 3.3% in Routt County (DOC, 2013).

Moffat and Routt County have experienced a boom in fluid mineral development. Moffat County has 2,857 producing wells and Routt County has 500 producing wells (IHS, 2015). Average annual production of oil from 2010 to 2013 increased in both Moffat and Routt counties, with both counties experiencing declines in production in 2014. Average annual production of gas increased in Routt County from 2010 to 2014, but gas production declined in Moffat County each year from 2010 to 2014. Overall, Moffat County has greater production of both oil and gas. The average annual fluid minerals production for each county is listed in Table 3-14. The production values are averaged over the past five full years from 2010 through 2014 (COGCC, 2015).

Table 3-14. Total Wells and Average Annual Oil and Gas Production by County 2010-2014

	Wells	Oil Production (barrels)	Gas Production (MCF)
Moffat County	500	2,008,732	87,847,776
Routt County	2,857	312,781	380,169

Leasing mineral rights for the development of federal minerals generates public revenue through the bonus bids paid at lease auctions and annual rents collected on leased parcels not held by production. Nominated parcels approved for leasing are offered by BLM at a minimum rate of \$2.00 per acre at the lease sale. These sales are competitive and parcels with high potential for oil and gas production often command bonus bids in excess of the minimum bid. In addition to bonus bids, lessees are required to pay rent annually until production begins on the leased parcel, or until the lease expires. These rent payments are equal to \$1.50 an acre for the first five years and \$2.00 an acre for the second five years of the lease.

The State of Colorado receives 49% of the total revenue associated with federal mineral leases. Federal mineral lease revenue for the State of Colorado is divided as such: 48.3 percent of all state mineral lease rent and royalty receipts are sent to the State Education Fund (to fund K-12 education), up to \$65 million in FY 2009 – FY 2011, and growing at four percent per year thereafter. Any amounts greater than the upper limit flow to the Higher Education Capital Fund. Ten percent of all state mineral lease rent and royalty receipts are sent to the Colorado Water

Conservation Board, up to \$13 million in FY 2009, and growing at four percent per year thereafter. Any amounts greater than the upper limit flow to the Higher Education Capital Fund. 1.7 percent of all state mineral lease rent and royalty receipts are distributed directly to local school districts originating the revenue or providing residence to energy employees and their children. Forty percent of all state mineral lease rent and royalty receipts are sent to the Colorado Department of Local Affairs, which then distributes half of the total amount received to a grant program, designed to provide assistance with offsetting community impacts due to mining, and the remaining half directly to the counties and municipalities originating the Federal mineral lease revenue or providing residence to energy employees.

Bonus payments are allocated separately from rents and royalties, in the following manner: 50 percent of all state mineral lease bonus payments are allocated to two separate higher education trust funds: the “Revenues Fund” and the “Maintenance and Reserve Fund”. The Revenues Fund receives the first \$50 million of bonus payments to pay debt service on outstanding higher education certificates of participation. The Maintenance and Reserve Fund receives 50 percent of any bonus payment allocations greater than \$50 million. These funds are designated for controlled maintenance on higher education facilities and other purposes. The remaining 50 percent of state mineral lease bonus payments are allocated to the Local Government Permanent Fund, which is designed to accumulate excess funds in trust for distribution in years during which Federal mineral lease revenues decline by ten percent or more from the preceding year.

Over the past two years, twenty-seven of the forty-eight lease parcels offered within LSFO (56 percent of offered parcels), totaling 21,946.25 acres, have been sold. From these sales the maximum bid on a parcel was \$120.00/acre, the minimum bid on a parcel was \$2.00/acre. The average bid was \$24.33/acre with standard deviation of \$35.28/acre. Sixteen of the twenty-seven parcels had bids of \$4.00/acre or less, twenty-one of the twenty-seven parcels had bids of \$41.00/acre or less, and two bids exceeded \$100.00/acre (DOI, 2015).

During the lease period annual lease rents continue until one or more wells are drilled that result in production and associated royalties. The federal oil and gas royalties on production from public domain minerals equal 12.5 percent of the value of production (43 CFR 3103.3.1).

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

The direct effect of the proposed action would be the payments received, if any, from leasing all or a subset of the 813.07 acres of federal mineral estate. Indirect effects that might result, should exploration and development of the leases occur, could include increased employment opportunities related to the oil and gas and service support industry in the region as well as the economic benefits to federal, state, and county governments related to lease payments, royalty payments, severance taxes, and property taxes. Other effects could include the potential for an increase in transportation, roads, and noise disturbance associated with development. These effects would apply to all public land users in the project area.

Due to energy market volatility and the dynamics of the oil and gas industry it is not feasible to predict the exact effects of this action, as there are no guarantees that the leases would receive bids, and that any leased parcels would be explored or that exploration would result in discovery of viable fluid mineral production. An estimate for the amount to be raised in the lease sale from

bonus bids can be estimated using the two year average from lease sales in the field office multiplied by the total acreage for sale multiplied by the percent of parcels sold. Over the past two year approximately 56 percent of all parcels proposed for leasing within LSFO received bids (DOI, 2015). The average bid from these sales was approximately \$24.33/acre. Based on this information the May 2016 lease sale could result in \$18,155.852 in total bonus bids, though the actual amount may vary based on factors including location of the parcels, firm portfolios, and energy market expectations.

As previously noted BLM cannot predict whether any of the leases sold would be developed. However, any Application for Permit to Drill received would require future site-specific analysis, in which further socio-economic effects, including any negative socio-economic effects resulting from disturbance and drilling on leased parcels, would be examined in future site-specific analysis. It is unknown when, where, how, or if future surface disturbing activities associated with oil and gas exploration and development such as well sites, roads, facilities, and associated infrastructure would be proposed. It is also not known how many wells, if any, would be drilled and/or completed, the types of technologies and equipment would be used and the types of infrastructure needed for production of oil and gas. Thus, the types, magnitude and duration of potential impacts cannot be precisely quantified at this time, and would vary according to many factors.

Environmental Justice Impacts

Executive Order 12898 requires Federal agencies to assess projects to ensure there is no disproportionately high or adverse environmental, health, or safety impacts on minority and low income populations. A review of current US Census data indicates that there are no low income and minority populations within the study area that meet the criteria for environmental justice consideration.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

Any possible future development of fluid mineral resources resulting from this lease sale would be in addition to the current level of development, as examined in the affected environment.

Potential Future Mitigation:

None.

3.4.3.6 Visual Resources

Affected Environment:

Visual resources are the visible physical features of a landscape to which concerned or visually sensitive publics assign scenic value. Scenic values in the LSFO have been inventoried as Visual Resource Inventory (VRI) conditions, and Visual Resource Management (VRM) objectives were established for BLM surface in the Little Snake RMP. Parcel 7416 is categorized as VRI Class III, with a scenic quality rating of B. Parcel 7429 is VRI Class II, with a scenic quality rating of

² Estimate calculated as Bonus Bid Total = Average Bid * Acres Offered * Percent of Parcels Sold

A (BLM 2011). Since both parcels are on private surface, they have no VRM classification, although Parcel 7416 is bordered on the south by BLM land classified as VRM IV.

Parcel 7416 is an ephemeral drainage with slopes on either side averaging 25 percent or greater, covered in deciduous oak and trees. Some dirt roads and fences cross the parcel, but there are no structures. Most likely viewing points are from state and county roads over a mile away, or BLM land on the southern border (Figure 3-8).

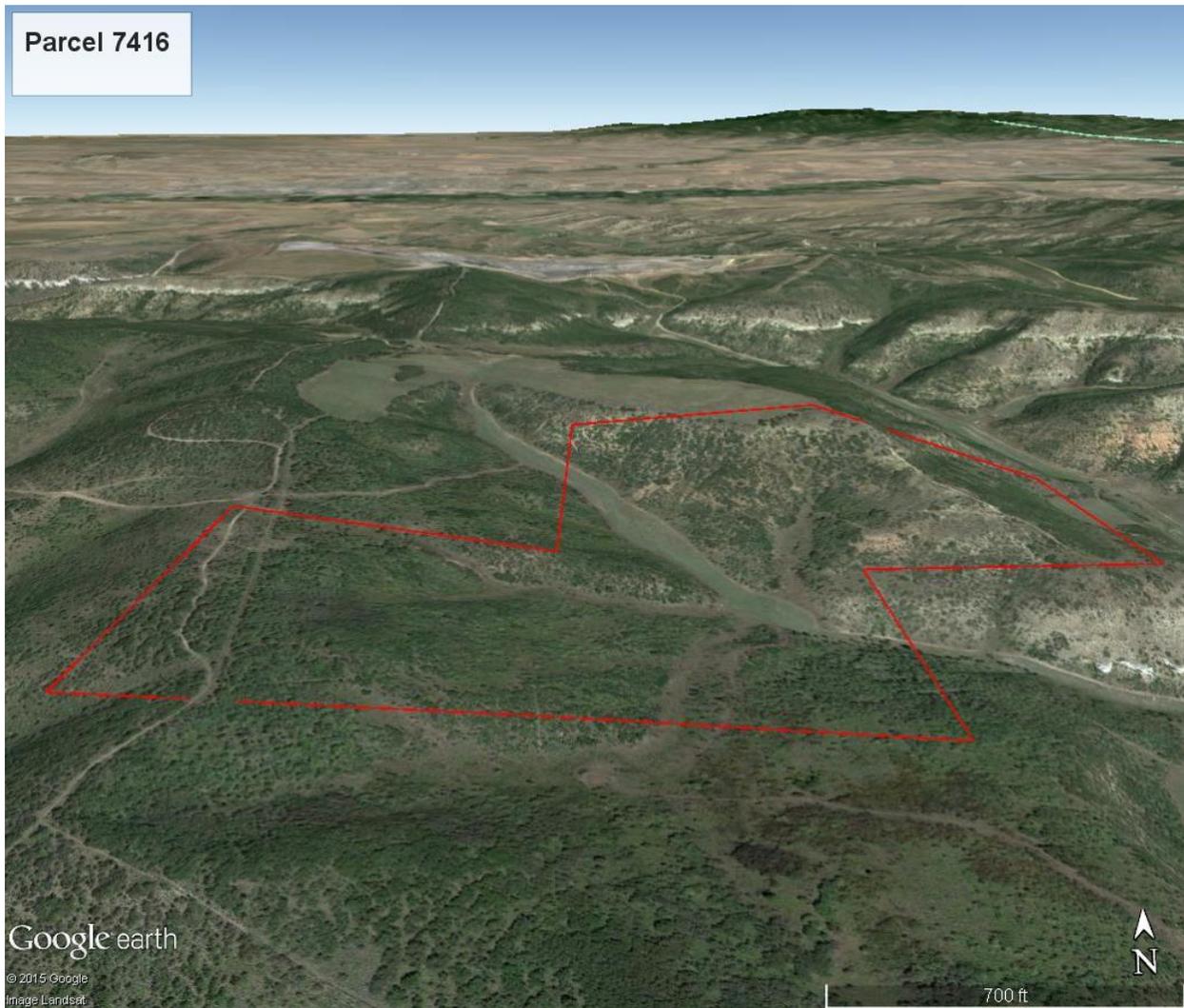


Figure 3-8. Landscape of Parcel 7416.

Parcel 7429 is mostly rolling hills of mixed shrub and aspen woodland, with intermittent wetlands. It is bisected by a graveled county road (CR 82) and has a number of dirt two-tracks throughout. There are few structures on this parcel. Most likely viewing points are from the public traveling down County Road 82, and from National Forest land on the southern border (Figure 3-9).



Figure 3-9. Landscape of Parcel 7429.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

The leasing of the proposed parcels in itself has no impact on visual resources. However, it is assumed that oil and gas exploration, development, and production would occur on parcels that are leased, and the development could affect landscape character.

For example, during construction, large trucks, cranes, and other large construction equipment would be present on the oil and gas site. Construction of the site, trenching, grading, surfacing, clearing, leveling, staging/parking area would modify the form and color of the land. During drilling, the drill rig would be lit at night, increasing its visibility on the landscape. These would be considered short-term impacts that would end when construction and drilling is completed.

Access roads connecting pads may need to be constructed (in areas where no roads presently exist) or improved upon (in areas where existing roads are present). New roads and well pads would create a linear, exposed soil route, and are often maintained for the life of the wells. Production facilities such as produced water, condensate or oil storage tanks could provide a

strong vertical and horizontal visual contrast in form and line to the characteristic landscape and vegetation.

Since oil and gas well locations cannot be accurately determined at the leasing stage, it is not possible to accurately predict the visual impacts. If an APD is submitted, a site specific analysis for proposed development would be conducted. On split-estate parcels, surface owners can negotiate with oil and gas operators to reduce visual impacts by siting roads and facilities in less sensitive areas, screening them with vegetation, and modifying facility shape and color.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

Incremental impacts on visual resources would occur from private land improvements, mining, oil and gas development, motorized recreation, and commercial activities in the CIAA. Oil and gas exploration and development of these lease Parcels would incrementally increase the likelihood of impacts to visual resources.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect visual resources would be analyzed and added at the APD stage, as appropriate.

3.4.4 Resource Uses

3.4.4.1 Access and Transportation

Affected Environment:

Parcel 7416 is private surface, and has no public access. It contains dirt roads for use by the private surface owner.

Parcel 7429 is also private surface, but does have County Road 82 running through the southern portion. It is integral with the Brush Mountain Ranch Conservation Easement for protection of big game habitat. The rest of the parcel contains dirt roads for use by the private surface owner.

Environmental Consequences of Leasing and Development - Direct and Indirect Impacts:

It is unknown exactly where and how the transportation system may be impacted by the leasing and subsequent oil and gas development of these parcels. It is assumed that this activity would occur in and near the proposed lease parcels. It is also assumed that existing roads would be upgraded and used for the majority of access to oil and gas developments and potentially new roads, typically short spur roads, would be constructed to reach well pads, pipelines, and other associated facilities. It is assumed that traffic volumes would increase in areas near and in the proposed leased parcels once these parcels are explored and developed, but which roads may be proposed for use, or if new roads would be proposed is unknown. Typically traffic volumes and heavy equipment use on roads to access and construct any new developments increase during the short 3 to 6 month duration of constructing and drilling the well pads. After interim reclamation and during the production phase traffic volumes typically decrease.

Environmental Consequences of Leasing and Development - Cumulative Impacts:

Combined with other existing traffic, traffic volumes are expected to incrementally increase during the development of these oil and gas leases. Overall, the transportation system may be upgraded to improve the quality of transportation system routes in areas associated with use by oil and gas traffic.

Potential Future Mitigation:

Site-specific mitigation measures, including the requirement to use BLM approved BMPs to protect access and transportation would be analyzed and added at the APD stage, as appropriate.

3.4.5 References Cited

- Armstrong, Harley J., and David G. Wolny
1989 Paleontological Resources of Northwest Colorado: a regional Analysis. Museum of Western Colorado, Grand Junction, Colorado.
- Bartmann, R.M., G.C. White, and L.H. Carpenter. 1992. Compensatory mortality in a Colorado mule deer population. Wildlife Monographs 121: 3-39.
- Bonnifield, Juanita and Kim Smith
1996 A Cultural Resource Inventory for the Slater Creek Falls Access Trail and Parking, Routt County, (RE-96-03-832-FS) Colorado. United States Forest Service Steam Boat Springs, Colorado. (RT.FS.NR82)
- BLM 2011 Bureau of Land Management, Little Snake Field Office. 2011. Visual Resources Inventory.
- BLM 2015a Bureau of Land Management, Washington Office, Oil and Gas statistics.
http://www.blm.gov/style/medialib/blm/wo/MINERALS_REALTY_AND_RESOURCE_PROTECTION/energy/oil_gas_statistics/data_sets.Par.69959.File.dat/summary.pdf Accessed December 2015.
- BLM 2015b Bureau of Land Management. NW Colorado Greater Sage-grouse RMP Amendment and EIS. September, 2015. <https://eplanning.blm.gov/epl-front-office/eplanning/planAndProjectSite.do?methodName=dispatchToPatternPage¤tPageId=48134> Accessed January 2016.
- Breternitz, David A.
1972 Report of Archaeological Resources within Coal Stripping Area, Williams fork Mountains, Moffat County, Colorado (subcontract #r807 B41050). University of Colorado, Boulder, Colorado. (MF.CM.R1)
- Caraveo, Carlos F., and John W. Greer
1980 The Results of A class III Cultural Resource Survey of the Trapper Mine Near Craig, Moffat County, Colorado (#AS 88-00-14) Archaeological Services, Mancos, Colorado. (4-00-81).

- CDWR Colorado Division of Water Resources web site database
<http://www.water.state.co.us/pubs/aquamap.asp> accessed 09/18/2015
- CDWR_b Water Sources and Demand for the Hydraulic Fracturing of Oil and Gas Wells in Colorado from 2010 through 2015
<http://water.state.co.us/DWRIPub/CGWC%20Meetings%20and%20Process%20Documents/Oil%20and%20Gas%20Water%20Sources%20Fact%20Sheet%20-%20Final.pdf>
- COGCC Colorado Oil and Gas Conservation Commission web site database
<http://cogcc.state.co.us/> accessed 04/01/2015
- COGCC_b Colorado Oil and Gas Conservation Commission Spill Analysis by Year 1999 – 3rd Qtr 2015
<http://cogcc.state.co.us/documents/data/downloads/environmental/SpillAnalysisByYear.pdf>
- DOC U.S. Department of Commerce. 2013. Bureau of Economic Analysis, Table CA1: Personal Income Summary and CA25N: Total full-time and part-time employment by NAICS industry
- DOI Department of Interior. 2015. Bureau of Land Management, Colorado State Office Oil and Gas Program
http://www.blm.gov/co/st/en/BLM_Programs/oilandgas/oil_and_gas_lease.html
- Envirofacts US Environmental Protection Agency Envirofacts database
<http://www.epa.gov/enviro/> accessed 09/23/2015
- EPA Overview: EPA's Draft Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources.
<http://www.epa.gov/hfstudy/overview-epas-draft-assessment-potential-impacts-hydraulic-fracturing-oil-and-gas-drinking> Accessed 12/21/2015
- FracFocus www.fracfocusdata.org (FracFocus) Accessed 12/22/2015
- Geist, V. 1978. Behavior. Pages 283-296 in J.L. Schmidt and D.L. Gilbert, eds. Big Game of North America, Ecology and Management. Wildlife Management Institute. Stackpole Books, Harrisburg, PA.
- Gilbert, M.M., and A.D. Chalfoun. 2011. Energy development affects populations of sagebrush songbirds in Wyoming. *Journal of Wildlife Management* 75(4): 816-824.
- Helldin, J.O. and A. Seiler. 2013. Effects of Roads on the Abundance of Birds in Swedish Forest and Farmland. *Habitat Fragmentation due to Transportation Infrastructure*. In: IENE

Conference 2003 Proceeding. Infra Eco Network Europe, Brussels, Belgium. On file at White River Field Office.

HIS IHS Energy. 2015. IHS - Enerdeq Browser, <https://my.ihsenergy.com/>

Hoffman, R. W. (Technical editor). 2001. Columbian sharp-tailed grouse conservation plan. Routt, Moffat, and Rio Blanco Counties, Northwest Colorado. Northwest Colorado Columbian Sharp-tailed Grouse Work Group and Colorado Division of Wildlife, Fort Collins, Colorado. 79pp.

Hoffman, R.W. and A.E. Thomas. 2007. Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus columbianus*): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region. 131pp. [Available online at: <http://www.fs.fed.us/r2/projects/scp/assessments/columbiansharptailedgrouse.pdf>]

Hoffman, R.W., K.A. Griffin, J.M. Knetter, M.A. Schroeder, A.D. Apa, J.D. Robinson, S.P. Espinosa, F.J. Christiansen, R.D. Northrup, D.A. Budeau, and M.J. Chutter. 2015. Guidelines for the management of Columbian sharp-tailed grouse populations and their habitats. Sage and Columbian Sharp-tailed Grouse Technical Committee, Western Association of Fish and Wildlife Agencies, Cheyenne, Wyoming. 80pp.

Inglefinger, F., and S. Anderson. 2004. Passerine response to roads associated with natural gas extraction in a sagebrush steppe habitat. *Western North American Naturalist* 64(3): 385-395.

Kainer, Roald E.

1984 Re Recording and Evaluaiton of 5MF.1960: An Historic Site on Trapper Mine Property South of Craig, Colorado. Mariah Associates, Environmental Associates, Casper, Wyoming. (MF.PA.R8)

Keesling, Henry S.

1987 A Cultural Reosurce Survey of the Proposed Routt County Spicer Pit CO-010-FU-87-2 in Routt County, Colorado. Department of the Interior, Little Snake Resource Area, Craig, Colorado. (TR.LM.NR27)

Little Snake RMP and EIS

Little Snake Field Office Record of Decision and Approved Resource Management Plan. October 2011.

http://www.blm.gov/co/st/en/fo/lisfo/plans/rmp_revision/rmp_docs.html

Mehls, Steven and Carol Mehls

1991 Coal Minning Survey in Routt& Moffat Counties, 1990-91. Western Historicla Studies, Inc., Boulder Colorado. (MC.CM.R1)

NRC 2013 Induced Seismicity Potential in Energy Technologies Committee on Induced Seismicity Potential in Energy Technologies, Committee on Earth Resources,

Committee on Geological and Geotechnical Engineering, Committee on Seismology and Geodynamics, Board on Earth Sciences and Resources, Division on Earth and Life Studies; Copyright 2013 by the National Academy of Sciences. The National Academies Press Washington, D.C. www.nap.edu

NRCS United State department of Agriculture Natural Resource Conservation Service Web Soil Survey database <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx> accessed 9/18/2015

Overturf, Jeff

1995 A Class III Cultural Resource Inventory for the Son o fBlack Maountain Surface Rock Replacement Bears Ranger District, Routt Naitonal Forest, Routt County, Colorado. United States Forest Service, Routt National Forest, Steamboat Springs, Colorado . (RT.FS.NR75)

Pashal, Lynne

2009 A Class II (Sample) Cultural Reosurce Invnetory for the Boulder Creek and Mount Olophant Allotment Management Plan, Hanhs Peak – Bears Ears Ranger District, Medicine Bow – Route Ntioinal Forests, Moffat and Routt Counties, Colorado. Unites States Forest Serive. Medicen Bow- Arapaho – Routt National Forests, Steamboat Springs, Coloradol. (MC.FS.R451)

Powell, J. 2003. Distribution, habitat use patterns, and elk response to human disturbance in the Jack Morrow Hills, Wyoming. Thesis, University of Wyoming, Laramie. [on file at the LSFO]

Preisler, H.K., A.A. Ager, and M.J. Wisdom. 2006. Statistical methods for analysing responses of wildlife to human disturbance. *Journal of Applied Ecology* 43: 164-172.

Reijnen, R. and R. Foppen. 2006. Chapter 12: Impact of Road Traffic on Breeding Bird Populations in J. Davenport and J. L. Davenport, editors, *The Ecology of Transportation Managing Mobility of the Environment*. *Environmental Pollution* 10: 255-274. Springer, The Netherlands. On file at White River Field Office.

RFD Reasonable Foreseeable Development: Oil and Gas in the Little Snake Field Office Administrative Boundary Area (LSFO) 2005

Riffell, S.K., K.J. Gutzwiller, and S.H. Anderson. 1996. Does repeated human intrusion cause cumulative declines in avian richness and abundance? *Ecological Applications* 6(2): 492-505.

Rost, G.R., and J.A. Bailey. 1979. Distribution of mule deer and elk in relation to roads. *Journal of Wildlife Management* 43(3): 634-641.

- Sawyer, H., M.J. Kauffman, and R.M. Nielson. 2009a. Influence of well pad activity on winter habitat selection patterns of mule deer. *Journal of Wildlife Management* 73(7): 1052-1061.
- Sawyer, H., R. Nielson, and D. Strickland. 2009b. Sublette Mule Deer Study (Phase II): Final Report 2007. Western Ecosystems Technology, Inc., Cheyenne, WY.
- Taylor, A.R. and R.L. Knight. 2003. Wildlife responses to recreation and associated visitor perceptions. *Ecological Applications* 13(4): 951-963.
- Todd Todd, David Keith, and University of California, Berkley, *Ground Water Hydrology* Second Edition, John Wiley and Sons Inc. 1980, (535 pp)
- Topper Ralf Topper, Karen L. Spray, William H. Bellis, Judith L. Hamilton, and Peter E. Barkmann, *Ground Water Atlas of Colorado* Special Publication 53 Colorado Geologic Survey 2003 <http://coloradogeologicalsurvey.org/water/groundwater-atlas/>
- Tweto, Ogden
1979 Geologic Map of Colorado. United States Geologic Survey, Department of the Interior, Reston, Virginia.
- USGS 2014 Mark D. Petersen, Morgan P. Moschetti, Peter M. Powers, Charles S. Mueller, Kathleen M. Haller, Arthur D. Frankel, Yuehua Zeng, Sanaz Rezaeian, Stephen C. Harmsen, Oliver S. Boyd, Edward H. Field, Rui Chen, Nicolas Luco, Russell L. Wheeler, Robert A. Williams, Anna H. Olsen, and Kenneth S. Rukstales. United States **“Seismic-Hazard Maps for the Conterminous United States, 2014”** United States Geologic Survey, Department of the Interior
- USGS 2006 David J. Wald, Bruce C. Worden, Vincent Quitoriano, and Kris L. Pankow “ShakeMap Manual: Technical Manual, User’s Guide, and Software Guide”
- Ward, A.L. 1985. The response of elk and mule deer to firewood gathering on the Medicine Bow Range in southcentral Wyoming. Pages 28-74 in R.W. Nelson, ed., *Proceedings of the 1984 Western States and Provinces Elk Workshop*, Edmonton, AB.
- Webb, S.L., M.R. Dzialak, R.G. Osborn, S.M. Harju, J.J. Wondzell, L.D. Hayden-wing, and J.B. Winstead. 2011. Using pellet groups to assess response on elk and deer to roads and energy development. *Wildlife Biology in Practice* 7(1): 32-40. Available online at <http://socpvs.org>.

CHAPTER 4– COORDINATION AND CONSULTATION

PERSONS/AGENCIES CONSULTED

Mike Baumann, CPW District Wildlife Manager, Craig, CO, via telephone, September 21, 2015.

*Tribal consultation was initiated in January 2016 with the following tribes:
 Ute Indian Tribe (a.k.a Northern Utes)
 Southern Ute Indian Tribe
 Ute Mountain Ute Tribe
 Eastern Shoshone Tribe*

LIST OF PREPARERS AND PARTICIPANTS

INTERDISCIPLINARY REVIEW

Name	Title	Resource
Stacey Burke	Realty Specialist	Realty Authorizations and Land Tenure
Paul Daggett	Mining Engineer	Floodplains, Hydrology/Ground and Surface, Minerals/(Fluid and Solid) and Geology, Soils, Groundwater and Surface Quality
Kyle Frary	Fire Management Specialist	Fire Management
Martin Hensley	Economist	Social and Economic Conditions
Ed Hollowed	Wildlife Biologist	Riparian/Wetland, Aquatic and Terrestrial Wildlife, Special Status Animals, Migratory Birds
Kathy McKinstry	Planning, Environmental, Litigation and FOIA Coordinator	NEPA
Chad Meister	Air Resource Specialist	Air Quality and Climate
Tracy Perfors	Natural Resource Specialist	Visual Resources, Hazardous or Solid Wastes, Lands with Wilderness Characteristics, Recreation, Access and Transportation, Wilderness, Scenic Byways
Mike Selle	Archaeologist	Cultural Resources, Paleontological Resources, Native American Religious Concerns
Heather Woodruff	Ecologist	Upland Vegetation, Invasive/ Non-Native Species, Wild Horses, Livestock Operations, Forestry, Areas of Critical Environmental Concern, Special Status Plant Species

Attachments:

Attachment A – All Nominated Parcels

Attachment B – Recommended Parcel Deferrals

Attachment C – Preferred Alternative Parcels with Stipulations for Lease

Attachment D – Stipulation Exhibits

Attachment E – Maps

Attachment F – Response to Public Comments

Attachment A - All Nominated Parcels

The Colorado State Office is analyzing **20** parcels containing **15,773.300** acres of Federal lands in the State of Colorado for oil and gas leasing.

THE FOLLOWING PUBLIC DOMAIN LANDS ARE SUBJECT TO FILINGS IN THE MANNER SPECIFIED IN THE APPLICABLE PORTIONS OF THE REGULATIONS IN 43 CFR, SUBPART 3120.

PARCEL ID: 7429

T.0100N., R.0880W., 6TH PM

Section 4: Lot 5-8;
Section 4: S2N2,S2;

Routt County
Colorado 641.440 Acres

PVT/BLM; CON: LSFO

PARCEL ID: 7416

T.0050N., R.0900W., 6TH PM

Section 8: Lot 10,11,13,14;

Moffat County
Colorado 171.630 Acres

PVT/BLM; CON: LSFO

PARCEL ID: 7427

T.0070N., R.0920W., 6TH PM

Section 19: Lot 11;

Moffat County
Colorado 26.150 Acres

PVT/BLM; CON: LSFO

PARCEL ID: 7430

T.0110N., R.0930W., 6TH PM

Section 3: Lot 1-4;
Section 3: S2N2,S2;

Moffat County

Colorado 638.840 Acres

BLM; CON: LSFO

PARCEL ID: 7434

T.0110N., R.0930W., 6TH PM

Section 6: Lot 1-7;
Section 6: S2NE,SE,SW,E2SW,SE;

Moffat County

Colorado 625.380 Acres

BLM; CON: LSFO

PARCEL ID: 7435

T.0110N., R.0930W., 6TH PM

Section 15: ALL;

Moffat County

Colorado 640.000 Acres

BLM; CON: LSFO

PARCEL ID: 7428

T.0080N., R.0940W., 6TH PM

Section 26: NWSW;

Moffat County

Colorado 40.000 Acres

PVT/BLM; CON: LSFO

PARCEL ID: 7431

T.0040N., R.0980W., 6TH PM

Section 36: Lot 4,5,12;
Section 36: W2W2;

Moffat County

Colorado 175.480 Acres

BLM; CON: LSFO, WRFO

PARCEL ID: 7432

T.0040N., R.0980W., 6TH PM

Section 36: Lot 13,16,18;

Moffat County

Colorado 62.120 Acres

BLM; CON: LSFO, WRFO

PARCEL ID: 7417

T.0100N., R.0980W., 6TH PM

Section 18: Lot 5-8;
Section 18: E2,E2W2;
Section 19: Lot 5-8;
Section 19: E2,E2W2;

Moffat County

Colorado 1272.760 Acres

BLM; CON: LSFO

PARCEL ID: 7418

T.0100N., R.0980W., 6TH PM

Section 17: ALL;
Section 20: ALL;
Section 21: N2;

Moffat County

Colorado 1600.000 Acres

BLM; CON: LSFO

PARCEL ID: 7419

T.0110N., R.0980W., 6TH PM

Section 9: W2;

Moffat County

Colorado 320.000 Acres

BLM; CON: LSFO

PARCEL ID: 7420

T.0110N., R.0980W., 6TH PM

Section 20: ALL;

Section 29: ALL;

Section 32: ALL;

Moffat County

Colorado 1920.000 Acres

BLM; CON: LSFO

PARCEL ID: 7421

T.0110N., R.0980W., 6TH PM

Section 21: ALL;

Section 28: ALL;

Section 33: ALL;

Moffat County

Colorado 1920.000 Acres

PARCEL ID: 7422

T.0110N., R.0980W., 6TH PM

Section 22: SWNE,W2,SE;

Section 27: ALL;

Section 34: ALL;

Moffat County
Colorado 1800.000 Acres

BLM; CON: LSFO

PARCEL ID: 7423

T.0110N., R.0980W., 6TH PM

Section 25: ALL;

Section 26: ALL;

Section 35: ALL;

Moffat County
Colorado 1920.000 Acres

BLM; CON: LSFO

PARCEL ID: 7433

T.0110N., R.0980W., 6TH PM

Section 19: Lot 5-8;

Section 19: E2,E2W2;

Section 30: Lot 5-8;

Section 30: E2,E2W2;

Section 31: Lot 5,6;

Section 31: NENW,SESE;

Moffat County
Colorado 1423.980 Acres

BLM; CON: LSFO

PARCEL ID: 7424

T.0120N., R.0980W., 6TH PM

Section 14: Lot 3,4;

Moffat County
Colorado 74.910 Acres

BLM; CON: LSFO

PARCEL ID: 7425

T.0120N., R.0980W., 6TH PM

Section 16: Lot 1-5;

Section 17: Lot 1,2;

Section 21: Lot 1,2;

Moffat County

Colorado 180.610 Acres

BLM; CON: LSFO

PARCEL ID: 7426

T.0120N., R.0980W., 6TH PM

Section 35: E2;

Moffat County

Colorado 320.000 Acres

BLM; CON: LSFO

Attachment B – Recommended Parcel Deferrals

The Colorado State Office is deferring all of **18** parcels containing **14,960.230** acres of Federal lands in the State of Colorado for oil and gas leasing.

THE FOLLOWING PUBLIC DOMAIN LANDS ARE SUBJECT TO FILINGS IN THE MANNER SPECIFIED IN THE APPLICABLE PORTIONS OF THE REGULATIONS IN 43 CFR, SUBPART 3120.

PARCEL ID: 7427

T.0070N., R.0920W., 6TH PM

Section 19: Lot 11;

Moffat County

Colorado 26.150 Acres

PVT/BLM; CON: LSFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7430

T.0110N., R.0930W., 6TH PM

Section 3: Lot 1-4;

Section 3: S2N2,S2;

Moffat County

Colorado 638.840 Acres

BLM; CON: LSFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7434

T.0110N., R.0930W., 6TH PM

Section 6: Lot 1-7;

Section 6: S2NE,SENE,E2SW,SE;

Moffat County

Colorado 625.380 Acres

BLM; CON: LSFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7435

T.0110N., R.0930W., 6TH PM

Section 15: ALL;

Moffat County

Colorado 640.000 Acres

BLM; CON: LSFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7428

T.0080N., R.0940W., 6TH PM

Section 26: NWSW;

Moffat County

Colorado 40.000 Acres

PVT/BLM; CON: LSFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7431

T.0040N., R.0980W., 6TH PM

Section 36: Lot 4,5,12;

Section 36: W2W2;

Moffat County

Colorado 175.480 Acres

BLM; CON: LSFO, WRFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7432

T.0040N., R.0980W., 6TH PM
Section 36: Lot 13,16,18;

Moffat County
Colorado 62.120 Acres

BLM; CON: LSFO, WRFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7417

T.0100N., R.0980W., 6TH PM
Section 18: Lot 5-8;
Section 18: E2,E2W2;
Section 19: Lot 5-8;
Section 19: E2,E2W2;

Moffat County
Colorado 1272.760 Acres

BLM; CON: LSFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7418

T.0100N., R.0980W., 6TH PM
Section 17: ALL;
Section 20: ALL;
Section 21: N2;

Moffat County
Colorado 1600.000 Acres

BLM; CON: LSFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7419

T.0110N., R.0980W., 6TH PM
Section 9: W2;

Moffat County
Colorado 320.000 Acres

BLM; CON: LSFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7420

T.0110N., R.0980W., 6TH PM
Section 20: ALL;
Section 29: ALL;
Section 32: ALL;

Moffat County
Colorado 1920.000 Acres

BLM; CON: LSFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7421

T.0110N., R.0980W., 6TH PM
Section 21: ALL;
Section 28: ALL;
Section 33: ALL;

Moffat County
Colorado 1920.000 Acres

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7422

T.0110N., R.0980W., 6TH PM
Section 22: SWNE,W2,SE;
Section 27: ALL;
Section 34: ALL;

Moffat County
Colorado 1800.000 Acres

BLM; CON: LSFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7423

T.0110N., R.0980W., 6TH PM

Section 25: ALL;

Section 26: ALL;

Section 35: ALL;

Moffat County

Colorado 1920.000 Acres

BLM; CON: LSFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7433

T.0110N., R.0980W., 6TH PM

Section 19: Lot 5-8;

Section 19: E2,E2W2;

Section 30: Lot 5-8;

Section 30: E2,E2W2;

Section 31: Lot 5,6;

Section 31: NENW,SESE;

Moffat County

Colorado 1423.980 Acres

BLM; CON: LSFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7424

T.0120N., R.0980W., 6TH PM

Section 14: Lot 3,4;

Moffat County

Colorado 74.910 Acres

BLM; CON: LSFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7425

T.0120N., R.0980W., 6TH PM

Section 16: Lot 1-5;

Section 17: Lot 1,2;

Section 21: Lot 1,2;

Moffat County

Colorado 180.610 Acres

BLM; CON: LSFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

PARCEL ID: 7426

T.0120N., R.0980W., 6TH PM

Section 35: E2;

Moffat County

Colorado 320.000 Acres

BLM; CON: LSFO

In sage-grouse habitat – deferred to allow time to complete the Northwest Colorado Greater Sage-Grouse Resource Management Plan Amendment (see Section 2.3 for details).

Attachment C – Preferred Alternative Parcels with Stipulations for Lease

The Colorado State Office is offering competitively **2** parcels containing **813.07 acres** of Federal mineral estate in the State of Colorado for oil and gas leasing.

Stipulations are No Surface Occupancy (NSO), Timing Limitation (TL), Controlled Surface Use (CSU), or Lease Notice.

THE FOLLOWING ACQUIRED LANDS ARE SUBJECT TO FILINGS IN THE MANNER SPECIFIED IN THE APPLICABLE PORTIONS OF THE REGULATIONS IN 43 CFR, SUBPART 3120.

PARCEL ID: 7416

T.0050N., R.0900W., 6TH PM

Section 8: Lot 10,11,13,14;

Moffat County

Colorado 171.630 Acres

All lands are subject to Exhibit LS-101 (TL) to protect crucial big game winter habitat.

All lands are subject to Exhibit LS-104 (TL) to protect Columbian sharp-tailed grouse crucial winter habitat.

All lands are subject to Exhibit LS-115 (TL) to protect elk calving areas.

All lands are subject to CO-29 (Lease Notice) to alert lessees of paleontological inventory requirements.

All lands are subject to Exhibit CO-34 to alert lessees of requirements under the Endangered Species Act.

All lands are subject to Exhibit CO-39 (CSU) to protect cultural resources.

All lands are subject to Exhibit CO-56 (Lease Notice) to alert lessees of potential for supplementary air quality analysis and mitigation.

The following lands are subject to Exhibit LS-103 (TL) to protect raptor nesting activity:

T.0050N., R.0900W., 6TH PM

Section 8: Lot 10;

The following lands are subject to Exhibit LS-106 (NSO) to protect raptor nest sites:

T.0050N., R.0900W., 6TH PM

Section 8: Lot 10;

The following lands are subject to Exhibit LS-110 (CSU) to protect fragile soils:

T.0050N., R.0900W., 6TH PM

Section 8: Lot 10, 11;

The following lands are subject to Exhibit LS-111 (CSU) to protect slopes greater than 35 percent:

T.0050N., R.0900W., 6TH PM

Section 8: Lot 10, 11;

PVT/BLM; CON: LSFO

PARCEL ID: 7429

T.0100N., R.0880W., 6TH PM

Section 4: Lot 5-8;

Section 4: S2N2,S2;

Routt County

Colorado 641.440 Acres

All lands are subject to Exhibit LS-104 (TL) to protect Columbian sharp-tailed grouse crucial winter habitat.

All lands are subject to Exhibit LS-115 (TL) to protect elk calving areas.

All lands are subject to Exhibit LS-117 (TL) to protect greater sandhill crane nesting and staging habitat.

All lands are subject to Exhibit CO-34 to alert lessees of requirements under the Endangered Species Act.

All lands are subject to Exhibit CO-39 (CSU) to protect cultural resources.

All lands are subject to Exhibit CO-56 (Lease Notice) to alert lessees of potential for supplementary air quality analysis and mitigation.

The following lands are subject to Exhibit LS-105 (NSO) to protect perennial water sources:

T.0100N., R.0880W., 6TH PM

Section 4: S2S2;

The following lands are subject to Exhibit LS-110 (CSU) to protect fragile soils:

T.0100N., R.0880W., 6TH PM

Section 4: Lot 5-8;

Section 4: SENE, S2NW, N2SW, SESW, S2SE, NESE;

The following lands are subject to Exhibit LS-111 (CSU) to protect slopes greater than 35 percent:

T.0100N., R.0880W., 6TH PM

Section 4: Lot 5-8;

Section 4: SENE, S2NW, N2SW, SESW, S2SE, NESE;

The following lands are subject to CO-29 (Lease Notice) to alert lessees of paleontological inventory requirements:

T.0100N., R.0880W., 6TH PM

Section 4: Lot 5-8;

Section 4: S2N2;

PVT/BLM; CON: LSFO

Attachment D – Stipulation Exhibits

Exhibit LS-101

Lease Number:

TIMING LIMITATION STIPULATION

Exhibit LS-101: Elk, Mule Deer, Pronghorn Antelope and/or Bighorn Sheep Crucial Winter Habitat Timing Limitation:

Crucial winter habitat will be closed to surface disturbing activities from December 1 to April 30, with the intent that this stipulation apply after the big game hunting season. In the case that hunting season extends later, exceptions will be applied through normal procedures.

On the lands described below:

Exhibit LS-103

Lease Number:

TIMING LIMITATION STIPULATION

Exhibit LS-103: Raptor nesting and fledgling habitat (golden eagle, osprey, all accipiters, falcons [except the kestrel], buteos, and owls, not including special status species raptors)

Timing Limitation:

Raptor nesting and fledgling habitat will be closed to surface disturbing activities from February 1 to August 15 within a 0.25 mile buffer zone around the nest site. However, during years when a nest site is unoccupied, or unoccupied by or after May 15, these seasonal limitations may be excepted. They may also be excepted once the young have fledged and dispersed from the nest.

On the lands described below:

Exhibit LS-104

Lease Number:

TIMING LIMITATION STIPULATION

**Exhibit LS-104: Columbian Sharp-Tailed Grouse Crucial Winter Habitat Timing
Limitation:**

Columbian sharp-tailed grouse crucial winter habitat will be closed from December 16 to March 15.

On the lands described below:

Exhibit LS-105

Lease Number:

NO SURFACE OCCUPANCY STIPULATION

Exhibit LS-105: Perennial Water Sources NSO:

No surface occupancy for up to 0.25 mile from perennial water sources, if necessary, depending on type and use of the water source, soil type, and slope steepness.

On the lands described below:

Exhibit LS-106

Lease Number:

NO SURFACE OCCUPANCY STIPULATION

Exhibit LS-106: Raptor Nest Sites (golden eagle, osprey, all accipiters, falcons [except the kestrel], buteos, and owls, not including special status species raptors) NSO:

No surface occupancy (NSO) will be allowed within a 0.25 mile radius of raptor nest sites. The NSO area could be altered depending upon the active status of the nest site or upon the geographical relationship of topographical barriers and vegetation screening to the nest site.

On the lands described below:

Exhibit LS-110

Lease Number:

CONTROLLED SURFACE USE STIPULATION

Exhibit LS-110: Fragile Soils: areas rated as highly or severely erodible by wind or water as described by the Natural Resources Conservation Service (NRCS) in the Area Soil Survey Report or as described by onsite inspection. Fragile soil criteria are also slopes greater than or equal to 35 percent if they have one of the other following soil characteristics: surface texture that is sand, loamy sand, very fine sandy loam, silty clay, or clay; a depth to bedrock of less than 20 inches; an erosion condition rated as “poor”; or a K-factor greater than 0.32:

Surface disturbing activities will be allowed on isolated sites that meet fragile soil criteria, but only when performance standards and objectives can be met.

Surface occupancy on public land will be permitted only where adherence to performance objectives for surface disturbing activities within fragile-soil areas is assured. Performance objectives for fragile soils include:

- Maintain soil productivity both by reducing soil loss from erosion and through proper handling of the soil material.
- Reduce the impact to offsite areas by controlling erosion and/or overland flow from these areas.
- Protect water quality and quantity of adjacent surface and ground water sources.
- Reduce accelerated erosion caused by surface disturbing activities.
- Select the best possible site for development to reduce impacts on soil and water resources.

On the lands described below:

Exhibit LS-111

Lease Number:

CONTROLLED SURFACE USE STIPULATION

Exhibit LS-111: Slopes Greater than 35 percent:

Before surface disturbance on slopes of 35 percent or greater, an engineering or reclamation plan must be approved by the authorized officer. Controlled Surface Use (CSU) stipulations may be accepted subject to an onsite impact analysis. CSU stipulations will not be applied when the authorized officer determines that relocation up to 200 meters can be applied to protect the riparian system during well siting.

On the lands described below:

Exhibit LS-115

Lease Number:

TIMING LIMITATION STIPULATION

Exhibit LS-115: Elk Calving Areas Timing Limitation:

Elk calving areas will be closed to surface disturbing activities from April 16 to June 30.

On the lands described below:

Exhibit LS-117

Lease Number:

TIMING LIMITATION STIPULATION

Exhibit LS-117: Greater Sandhill Crane Nesting and Staging Habitat Timing Limitation:

Nesting and staging habitat areas will be closed to surface disturbing activities from March 1 to October 16.

On the lands described below:

Exhibit LS-129

Lease Number:

NO SURFACE OCCUPANCY STIPULATION

Exhibit LS-129: Areas Leased for Surface Coal Mining:

No surface occupancy areas include leases within the area of federally leased coal lands for surface coal mines where oil and gas development would likely be incompatible with coal extraction; the NSO stipulation may be waived if the lessee agrees to the outlined conditions.

On the lands described below:

Exhibit CO-29

Lease Number:

LEASE NOTICE

The lessee is hereby notified that prior to any surface disturbing activities, an inventory of paleontological resources (fossils) may be required. Mitigation may be required such as monitoring in any area of PFYC 4 or 5 and also upon the discovery of any vertebrate fossil or other scientifically important paleontological resource. Mitigation of scientifically important paleontological resources may include avoidance, monitoring, collection, excavation, or sampling. Mitigation of discovered scientifically important paleontological resources may require the relocation of the surface disturbance activity over 200 meters. Inventory and any subsequent mitigation shall be conducted by a BLM permitted paleontologist.

On the lands described below:

Exhibit CO-34

Lease Number:

ENDANGERED SPECIES ACT SECTION 7 CONSULTATION STIPULATION

The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended, 16 U.S.C. § 1531 *et seq.*, including completion of any required procedure for conference or consultation.

On the lands described below:

Exhibit CO-39

Lease Number:

CONTROLLED SURFACE USE

This lease may be found to contain historic properties and/or resources protected under the National Historic Preservation Act (NHPA), American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, E.O.13007, or other statutes and executive orders. The BLM will not approve any ground disturbing activities that may affect any such properties or resources until it completes its obligations under applicable requirements of the NHPA and other authorities. The BLM may require modification to exploration or development proposals to protect such properties, or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized or mitigated.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820.)

On the lands described below:

Exhibit CO-56

Lease Number: <LEASE_NUMBER>

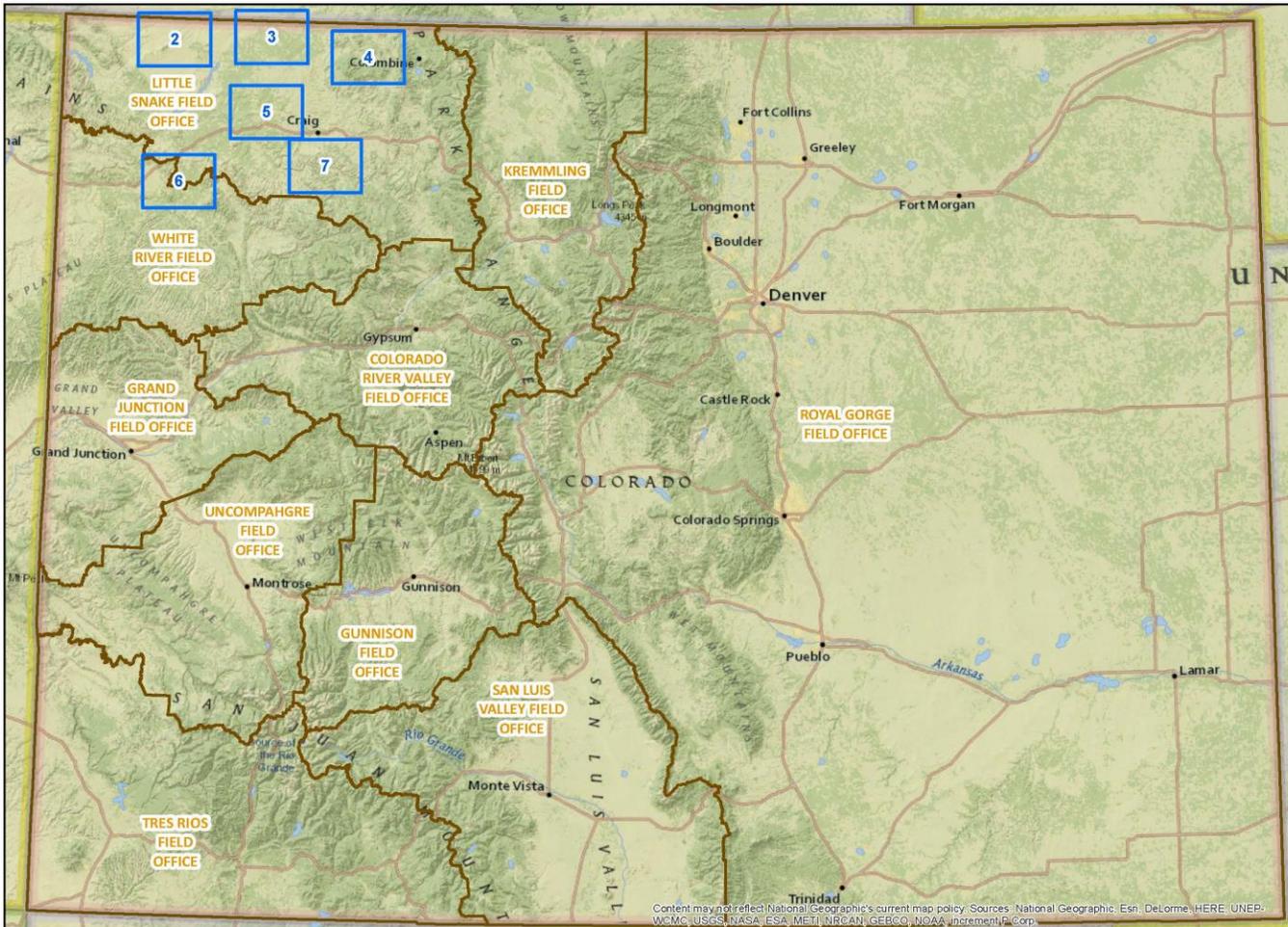
LEASE NOTICE

Due to potential air quality concerns, supplementary air quality analysis may be required for any proposed development of this lease. This may include preparing a comprehensive emissions inventory, performing air quality modeling, and initiating interagency consultation with affected land managers and air quality regulators to determine potential mitigation options for any predicted significant impacts from the proposed development. Potential mitigation may include limiting the time, place, and pace of any proposed development, as well as providing for the best air quality control technology and/or management practices necessary to achieve area-wide air resource protection objectives. Mitigation measures would be analyzed through the appropriate level of NEPA analysis to determine effectiveness, and will be required or implemented as a permit condition of approval (COA). At a minimum, all projects and permitted uses implemented under this lease will comply with all applicable National Ambient Air Quality Standards and ensure Air Quality Related Values are protected in nearby Class I or Sensitive Class II areas that are afforded additional air quality protection under the Clean Air Act (CAA).

On the lands described below:

Attachment E - Maps

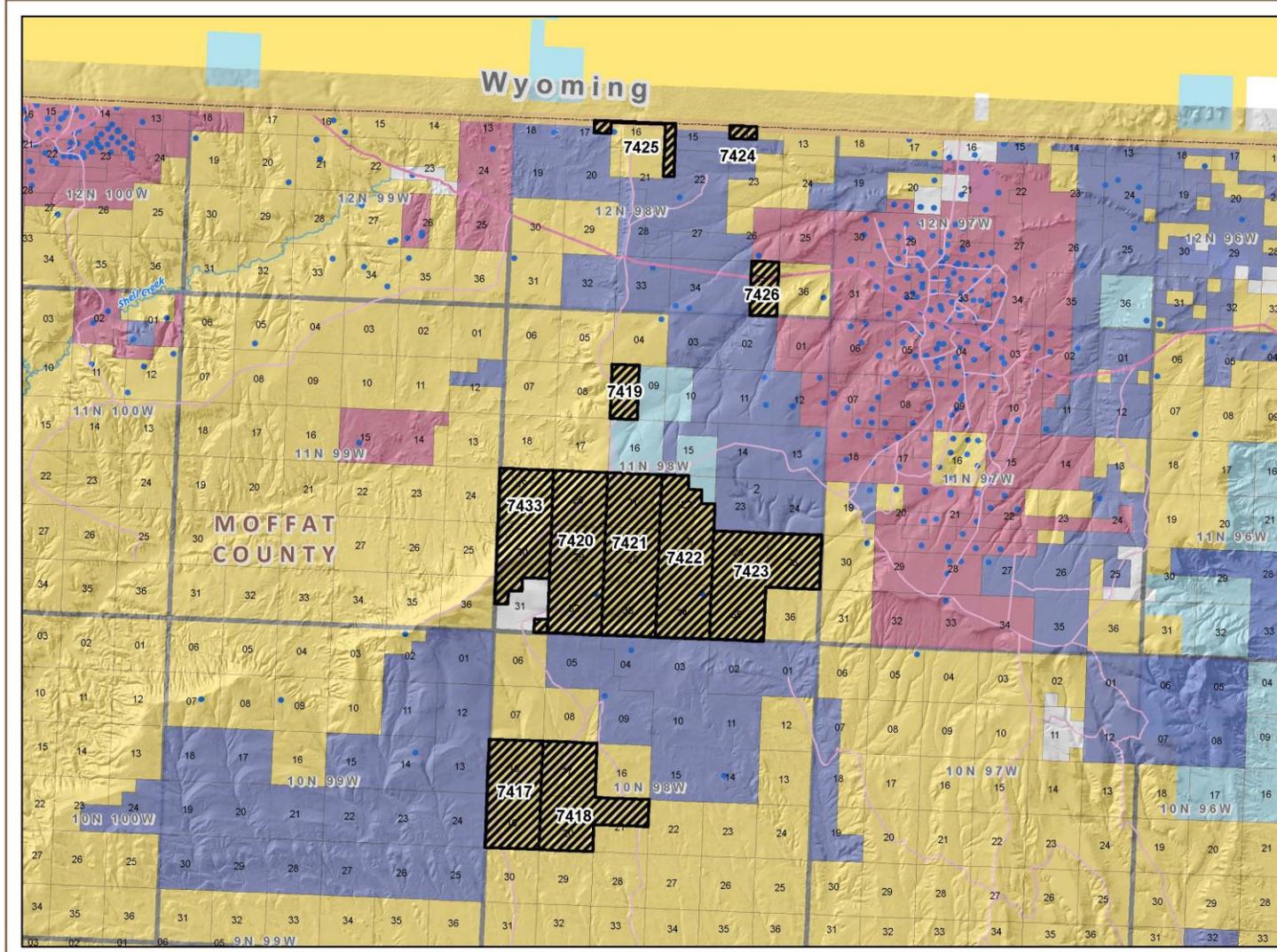
BLM Competitive Oil and Gas Lease Sale May, 2016



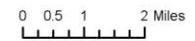
**Bureau of Land Management
Competitive Oil & Gas Lease Sale
May, 2016**



NOTE TO MAP USERS
No warrantee is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of the data layers shown on this map. The official land records should be checked for the current status on any specific tract of land.



- Legend**
- BLM Field Office Areas Boundaries
 - Recommended Oil & Gas Sale Status**
 - Deferral
 - COGCC Oil and Gas Well Locations
 - Oil and Gas Leases**
 - Non-Producing Leases
 - Producing Leases
 - Bureau of Land Management
 - Private
 - State
 - Township & Range
 - Sections
 - Lakes and Reservoirs
 - CDDT Local Roads
 - Streams



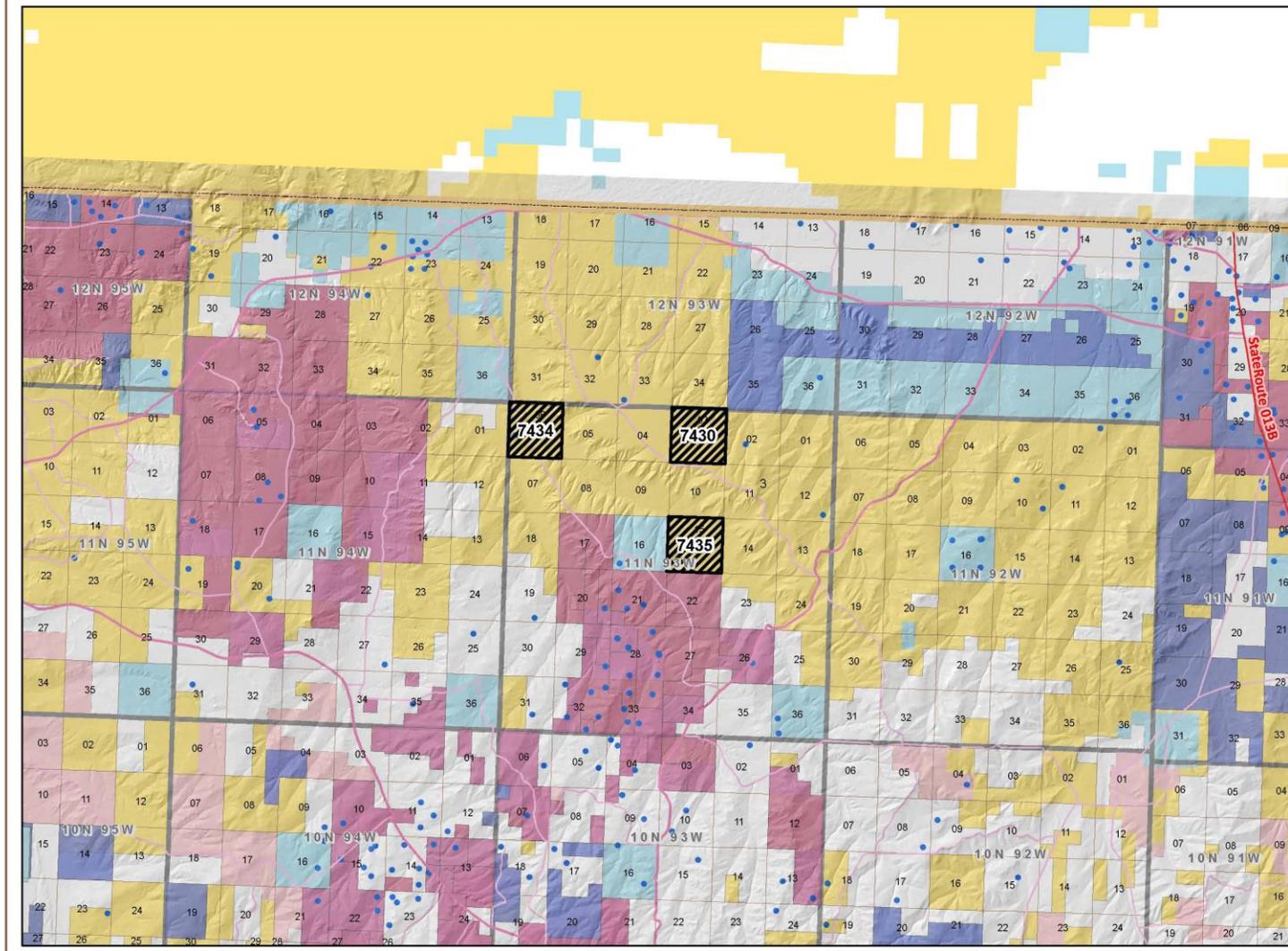
**Map Page Location
Page Number 2**



**Bureau of Land Management
Competitive Oil & Gas Lease Sale
May, 2016**



NOTE TO MAP USERS
No warrantee is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of the data layers shown on this map. The official land records should be checked for the current status on any specific tract of land.



Legend

- BLM Field Office Areas Boundaries
- Recommended Oil & Gas Sale Status**
- Deferral
- COGCC Oil and Gas Well Locations
- Oil and Gas Leases**
- Non-Producing Leases
- Producing Leases
- Bureau of Land Management
- Private
- State
- Bankhead-Jones Land Use Lands
- Township & Range
- Sections
- Minor Highways
- CDOT Local Roads



**Map Page Location
Page Number 3**

LITTLE SNAKE FIELD OFFICE



**Bureau of Land Management
Competitive Oil & Gas Lease Sale
May, 2016**



NOTE TO MAP USERS
No warrantee is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of the data layers shown on this map. The official land records should be checked for the current status on any specific tract of land.

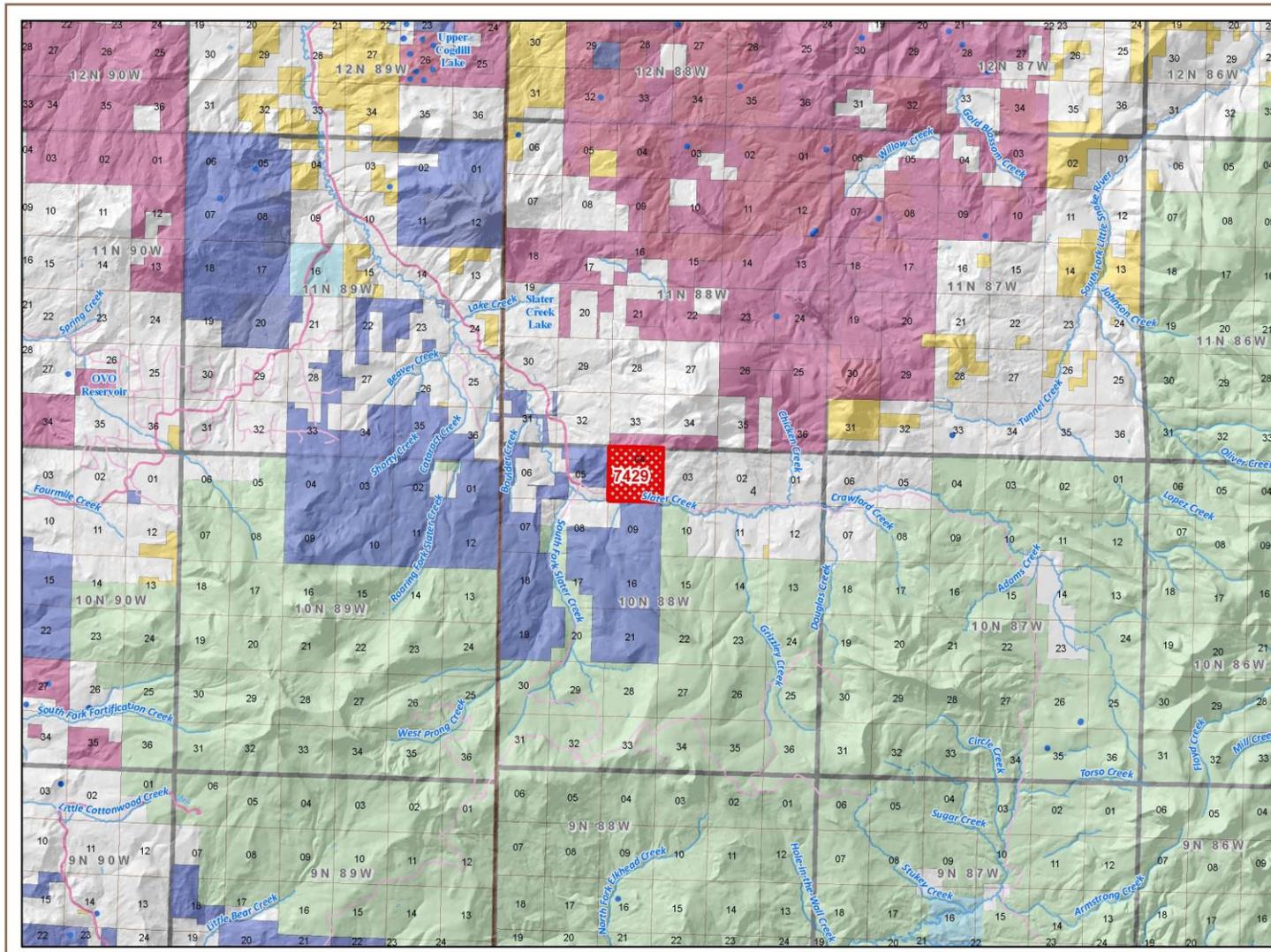
Legend

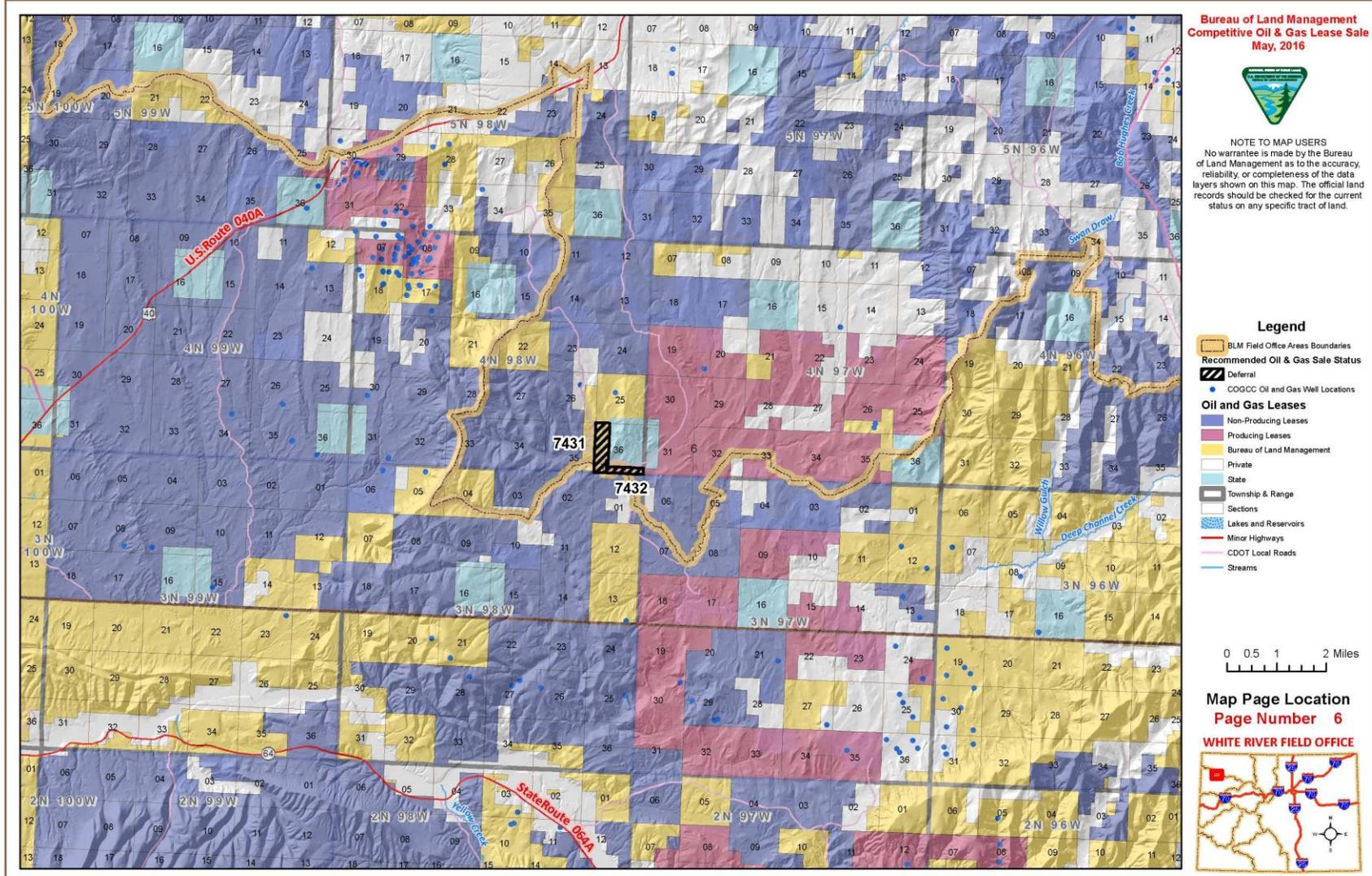
- BLM Field Office Areas Boundaries
- Recommended Oil & Gas Sale Status**
- Sale
- COGCC Oil and Gas Well Locations
- Oil and Gas Leases**
- Non-Producing Leases
- Producing Leases
- Bureau of Land Management
- Private
- State
- US Forest Service
- Township & Range Sections
- Lakes and Reservoirs
- CDOT Local Roads
- Streams



**Map Page Location
Page Number 4**

LITTLE SNAKE FIELD OFFICE





**Bureau of Land Management
Competitive Oil & Gas Lease Sale
May, 2016**



NOTE TO MAP USERS
No warrantee is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of the data layers shown on this map. The official land records should be checked for the current status on any specific tract of land.

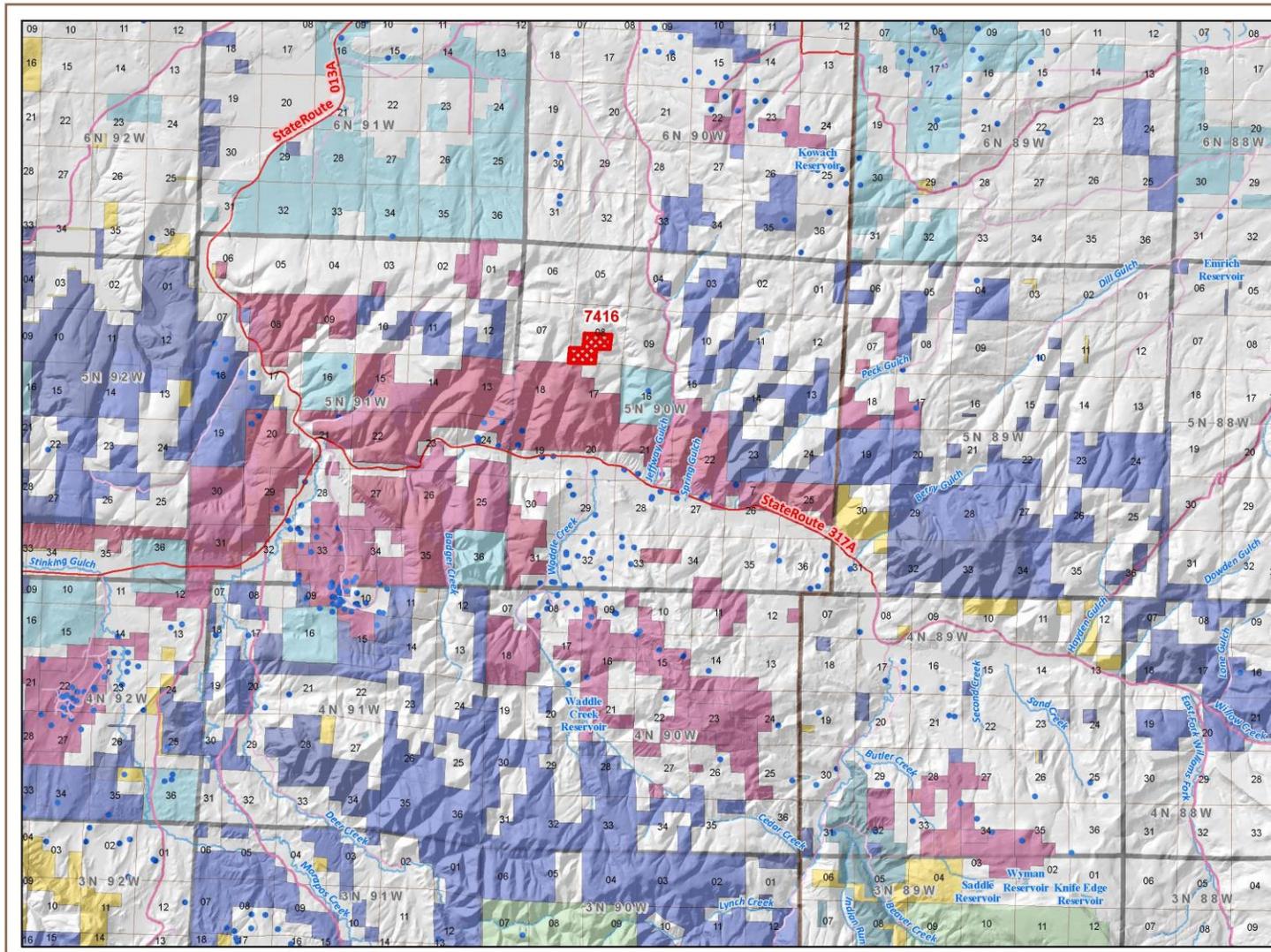
Legend

- BLM Field Office Areas Boundaries
- Recommended Oil & Gas Sale Status**
- Sale
- COGCC Oil and Gas Well Locations
- Oil and Gas Leases**
- Non-Producing Leases
- Producing Leases
- Bureau of Land Management
- Private
- State
- State, County, City, Areas
- US Forest Service
- Township & Range
- Sections
- Lakes and Reservoirs
- Minor Highways
- CDDT Local Roads
- Streams



**Map Page Location
Page Number 7**

LITTLE SNAKE FIELD OFFICE



Attachment F – Response to Public Comments

BLM received five comments about the proposed May 2016 oil and gas lease sale from November 12, 2015 until December 14, 2015. One commentor was a private individual, one was a local government agency, and three were organizations. Two comments supported leasing Parcels 7416 and 7429 as proposed, while three commenters had concerns about issues such as hydraulic fracturing, air and water quality, water depletions, climate change, Columbian sharp-tailed grouse, aquatic wildlife, wetlands, terrestrial wildlife, invasive species, environmental justice, and compliance with NEPA. One commentor opposed the deferral of the other 18 nominated parcels. The comments are summarized below, with BLM’s responses.

BLM received one comment after the December 14, 2015 deadline, with concerns about air quality, climate change and hydraulic fracturing. This comment was also considered and responded to below.

Comments Related to Vegetation

Comment: Oil and gas development leads to habitat loss. One commentor stated: *“Oil and gas development creates a network of well pads, roads, pipelines, and other infrastructure that lead to direct habitat loss and fragmentation, as well as displacement of wildlife from these areas due to increased human disturbance. Habitat loss occurs as a result of a reduction in the total area of the habitat, the decrease of the interior-to-edge ratio, isolation of one habitat fragment from another, breaking up of one habitat into several smaller patches of habitat, and decreasing the average size of a habitat patch.”*

BLM Response: As stated in the EA Section 3.4.2.4, actual impacts of oil and gas development activities on upland vegetation cannot be predicted at the leasing stage. Most vegetation loss as a result of oil and gas development would be for a relatively short timeframe because successful interim and final reclamation would help return desirable vegetation and ecological function to disturbed sites. Where plant communities are dominated by invasive annuals or noxious weeds, successful reclamation of those disturbances would likely improve the condition of the plant community.

All oil and gas leases must comply with the reclamation standards set forth in Appendix C of the 2011 Little Snake RMP. Reclamation will ensure surface and subsurface stability, growth of a self-regenerating, permanent vegetative cover, and compatibility with post disturbance land use. The vegetation will be diverse and of the same seasonal growth as adjoining vegetation.

BLM was not provided with any new objective data or information not previously considered in the EA and RMP EIS, so no changes were made.

Comment: Oil and gas development can spread invasive weeds. One commentor stated: *“Invasive species may be introduced through a variety of pathways that would be increasingly common if oil and gas activity is allowed to expand. Machinery, equipment, and trucks moved*

from site to site can carry invasive plant species to new areas. In addition, materials such as crushed stone or gravel transported to the site from other locations may serve as a conduit for invasive species to migrate to the well site or other areas en route.”

BLM Response: As stated in the EA Section 3.4.2.1, invasive weed species can be introduced in a variety of ways. Machinery, equipment, and vehicles are just a few vectors in which invasive weed species can be moved. However, wind, recreational vehicles, wildlife and livestock are other vectors in which invasive weed species can be moved and must be taken into account. At the leasing stage site specific mitigation for weed management is not applied, it is designed at the APD stage as stated in the EA. At the APD stage site specific BMPs, COAs and mitigation are applied to help limit invasive weed infestations as a result of oil and gas development. Please see Appendix C of the 2011 Little Snake RMP as it contains specific surface disturbance reclamation requirements devoted to the management of Invasive, Noxious and Non-Native species.

BLM was not provided with any new objective data or information not previously considered in the EA and RMP EIS, so no changes were made.

Comments Related to Hydraulic Fracturing (“fracking”), Hazardous Materials and Water Quality

Comment: Three commenters had concerns about hydraulic fracturing, and one requested more analysis of possible risks of hydraulic fracturing, including aquifer contamination through migration of hydraulic fracturing fluid (frack fluid) and hydrocarbons from the fractures, groundwater contamination through spills of frack fluid and produced water, induced seismicity, health effects of gasses released during the hydraulic fracturing process, and water depletions. They wanted to know what specific monitoring and mitigation BLM would require. As one commenter stated:

“The PEA hardly discusses fracking. It does mention some of the potential implications of the use of hydraulic fracturing, such as possibility of spills and contamination of ground and surface water. The Center’s review of this material finds the PEA is severely deficient for purposes of the intended function of an environmental assessment, which is to determine whether or not a proposed action may have significant effects on the human environment. General information about hydraulic fracturing, however, fails to fill the gap in the PEA’s analysis. The PEA contains no discussion whatsoever of the impact of fracking on specific geological formations, surface and ground water resources, seismic potential, or human, animal, and plant health and safety concerns present in the area to be leased.”

BLM Response: The EA qualitatively describes the potential for aquifer contamination through loss of well integrity or migration through hydraulic fractures (3.4.1.3), spill impacts on soils (3.4.1.6), on groundwater (3.4.1.7), and on aquatic wildlife (3.4.2.6), and the handling, cleanup and disposal of hazardous materials (3.4.2.6). These sections also described current regulations mitigating the risks, and the potential for additional conditions of approval after site-specific

analysis at the APD stage. Oil and gas development impacts on these resources are also discussed in the LSFO RMP EIS, which the EA incorporated by reference.

BLM's NEPA Handbook (H- 1790-1, January 2008) at page 59 states, "...you are not required to speculate about future actions. Reasonably foreseeable future actions are those for which there are existing decisions, funding, formal proposals, or which are highly probable, based on known opportunities or trends."

At the lease-sale stage BLM does not yet know 1) if a lease parcel proposed for an oil and gas lease sale will be purchased and result in the issuance of an oil and gas lease; 2) whether an application for permit to drill (APD) will be submitted on a lease that is issued for a proposed lease parcel, and 3) the specific location and operating procedures, such as the use of hydraulic fracturing, the target product, the geologic formations targeted or drilled through, the distance to other wells or residences, and the source or disposal method of water, for any oil and gas operations that might be proposed in an APD. In light of the uncertainties that exist at this time, conducting the detailed analysis and addressing the issues raised in this comment on the potential impacts of hydraulic fracturing would require a great deal of speculation and, as a result, offer little information useful for the decision-maker.

Additional discussion has been added to EA Sections 3.4.1.5, 3.4.1.7 and 3.4.1.8 to help clarify uncertainties. The potential impacts of a specific drilling proposal that includes the use of hydraulic fracturing is more appropriately analyzed if and when a site-specific and detailed drilling proposal is submitted.

Comment: Hydraulic fracturing is new and has changed since previous analysis. Citing Arthur Daniel's *Hydraulic Fracturing Considerations for Natural Gas Wells of the Marcellus Shale*, the commenter stated "*Elements of these technologies have been used individually for decades. However, the combination of practices employed by industry recently is new: Modern formation stimulation practices have become more complex and the process has developed into a sophisticated, engineered process in which production companies strive to design a hydraulic fracturing treatment to emplace fracture networks in specific areas.*"

BLM Response: See also **Comments Related to the NEPA Process** for discussion on how the 2011 Little Snake RMP EIS analyzed hydraulic fracturing.

The Daniels citation states that hydraulic fracturing has been used in Appalachia since the 1960's, and horizontal drilling was considered standard industry practice by the 1980's. The citation goes on to explain that recent advances have focused on better modeling to ensure fractures "allow geologists and engineers to modify the design of a hydraulic fracture treatment and evaluate the height, length and orientation of potential fracture development prior to initiation of the actual fracture treatment." A more focused and refined hydraulic fracturing job is less risky, not more. Other recent changes involve changes in frac fluid ingredients. As described in Appendix H of the LSFO RMP EIS, and EA Sections 3.4.1.3, 3.4.1.6, 3.4.1.7, 3.4.1.8, and 3.4.3.2, current BLM and COGCC regulations, such as surface casing placement and mechanical integrity tests, and spill containment and cleanup, decrease the risk from frac fluid spills entering the environment, regardless what particular ingredients are in it. In summary, this citation does

not provide any new objective data or information of risks not previously considered or mitigated.

Comment: BLM must properly evaluate the risks to groundwater from hydraulic fracturing, including from surface spills sinking into aquifers, and from faulty well construction. Citing Dr. Ingraffea's *Some Scientific Failings within High Volume Hydraulic Fracturing Proposed Regulations* 6 NYCRR Parts 550-556, 560, Comments and Recommendations Submitted to the NYS Dept. of Environmental Conservation (Jan 8, 2013), the commenter stated "*Dr. Ingraffea of Cornell has noted an 8.9 percent failure rate for wells in the Marcellus Shale.*"

BLM Response: As noted above, risks to groundwater from spills and well leaks have been analyzed in Appendix H of the LSFO RMP EIS, and EA Sections 3.4.1.3, 3.4.1.6, 3.4.1.7, 3.4.1.8, and 3.4.3.2. The 8.9% failure rate noted by Dr. Ingraffea was for wells in Pennsylvania. Any wells drilled on Parcel 7416 and 7429 would be subject to BLM and COGCC regulations. Many violations that Dr. Ingraffea notes as "failures", such as diameter of bore hole not 1 inch greater than casing/casing collar diameter, would be identified and fixed by BLM and COGCC during permit review, before a permit is even issued. Other violations, such as inadequate, insufficient, and/or improperly installed cement, would be identified by BLM and COGCC-mandated review of bond logs and mechanical integrity testing during drilling, and fixed on site, without contaminants ever leaving the well bore. Thus, this citation does not track risks for wells drilled under BLM and COGCC regulations, resulting in a greatly overestimated failure and contamination risk, and so does not apply to potential wells drilled in the project lease parcels. Additional language has been added to Sections 3.4.1.7 and Section 3.4.1.8 to help clarify potential impacts.

Comment: "*BLM should also ban new hydraulic fracturing and other unconventional well stimulation activities in the planning area.*"

BLM Response: This is outside the scope of the proposed project. This project considers the possible leasing of Parcel 7416 and 7429, and deferral of 18 other parcels. Oil and gas development practices in the rest of the field office were considered in the 2011 RMP, and will continue to be considered in their own NEPA process as new APDs are submitted.

Comment: Hazardous materials used and produced during drilling can cause contamination of land and water through spills on the drilling location, spills during transport, and improper disposal. The commenter stated "*The EIS should examine and quantify the risks to human health and the environment associated with on-site chemical and wastewater storage, including risks from natural events and negligent operator practices.*"

BLM Response: Hazardous materials, regulations requiring proper storage and cleanup, and impacts of releases are addressed in EA Sections 3.4.1.3, 3.4.1.6, 3.4.1.7, 3.4.1.8, 3.4.2.6 and 3.4.3.2. Quantification of risks is not possible at the leasing stage, since site specific data like location, number of wells to be drilled, transportation routes, and source and disposal methods is not known. At the APD stage, site specific BMPs, COAs and mitigation are applied to help limit risks from hazardous materials.

Comment: Sediment runoff should be analyzed. As one commentor stated: *“Oil and gas operations require land clearance for access roads, pipelines, well pads, drilling equipment, chemical storage, and waste disposal pits. As a result, new oil and gas development will cause short-term disturbance as well as long-term disturbance within the planning area. While undisturbed land can retain greater amounts of water through plants and pervious soil, land that has been disturbed or developed may be unable to retain as much water, thereby increasing the volume of runoff.”*

BLM Response: BLM was not provided with any new objective data or information not previously considered in the EA. Sediment runoff is addressed in EA Sections 3.4.1.4, 3.4.1.6, 3.4.1.8, 3.4.2.4, 3.4.2.5, 3.4.2.6, 3.4.3.1, and 3.4.3.4, and stipulations LS 105, LS 110 and LS 111 have been applied to mitigate risk. The commentor has not explained how this analysis or mitigation is inadequate.

Comment: BLM failed to include any analysis of the seismic risks posed by the lease sale. Earthquakes induced by fluid injection, or hydraulic fracturing, in the U.S. are a well-known threat to human health and safety and infrastructure.

BLM Response: Discussion of the risk of induced seismicity from hydraulic fracturing and wastewater disposal wells has been added to Section 3.4.1.5 Minerals (Fluid and Solid) and Geology.

Comments Related to Air Quality and Climate:

Comment: Four commenters had concerns regarding air quality and climate change. The comments centered on the following issues:

1. BLM unlawfully restricted its NEPA analysis by failing to analyze sufficiently site-specific impacts, including air quality and climate change.
2. BLM failed to follow the Council on Environmental Quality guidance on climate change and NEPA.
3. BLM unreasonably restricts its air quality analysis by assuming, due to a 2-year negative trend in LSFO well starts, that drilling will follow the “Low scenario” of just 26 wells per year from the LSFO RFD.

BLM Response: This sale does not authorize changes to the human natural environment or allow for any site specific surface disturbance activity on any parcel that is successfully leased. Any subsequent exploration and development that may be authorized in the future is speculative at leasing. Before any future surface-disturbing activities can occur, BLM will provide for an environmental review as required by NEPA (EA Section 1.1). Whether or not these leases would be explored or developed is not reasonably foreseeable as development activity is influenced by many economic considerations. BLM has decades of historical data to suggest that only about 35% of leased areas are in production at any point in time (BLM 2015a). Further complicating this issue is the fact that energy markets are likely to be subject to some uncertainty

over the next several decades as the nation and the world address climate change drivers and adaptation.

BLM cannot forecast the number of wells that would ultimately be developed on any particular parcel, or as part of a grouping of such parcels for any lease sale over what could be several years and potentially multiple phases of development (even on individual parcels). Further, BLM cannot confidently estimate what economically viable quantities of oil and gas resources could exist for any parcel. Parcels that are leased will likely undergo exploration to determine what the true potential for the resource is. BLM cannot know with certainty what exact methods of well development (including, for example, hydraulic fracturing and directional drilling) may or may not be employed to develop a parcel. The methods for extraction and gathering and their relative intensities will depend on the types and quantities of any resources found.

As one commenter points out, lessees have an initial ten year period to propose exploration and development once the lease is issued. Potential changes in drilling and extraction methods over that timeframe could limit the value of any assumptions about such methods made at the leasing stage. When the facts and details for any future exploration and/or development project are provided to BLM in the form of an application or development plan, BLM will have or will request the information necessary to accurately and adequately characterize any changes to the environment that could result from such a proposal. Stipulation CO-56 has been applied to each parcel, assuring that any analysis that predicts unacceptable air quality impacts or undue degradation will be mitigated with appropriate conditions of approval (EA Section 3.4.1).

However, the EA provides estimated data describing potential emissions from future development. The EA presents development and production related emissions estimates on a per well basis (EA Section 3.4.1). The emissions data presented in the EA is for all applicable construction and operational activities and explicitly includes non-road engine emissions estimates from hydraulic stimulation pump engines and larger rig engines to account for the deeper horizontal drilling that occurs in the basin. The inventories include typical well pad equipment sets such as pneumatic devices, separators, tanks, pumps, small engines, control equipment, and also accounts for all of the associated traffic and mobile equipment emissions from development and operational activities. The typical well inventory provides estimates for all of the criteria pollutants, hazardous air pollutants, and greenhouse gases (including methane).

BLM also disclosed the LSFO source apportionment results from the 2015 Colorado Air Resources Management Modeling Study (CARMMS) analysis for cumulative development scenarios (low, medium, and high) across the LSFO and the entire State of Colorado. The low scenario is presented in the EA to describe what the projected development impacts would look like in 2021 given the current development trends (i.e. development since the 2011 base model emissions inventory year). The EA does not suggest that the low scenario will be applicable at the time of development; merely that at present the available information is consistent with the low development data. In addition to the trends data the EA shows the modeled emissions and the number of wells the emissions data represents. The scenario results describe how the atmosphere responds to specific emissions loading from the modeled inventories. The CARMMS results included in the EA covered all of the applicable air quality related values data (PSD increments, deposition, and visibility) for the highest impacted areas of concern. The EA

provided results for the 4th highest 8-hour average ozone formation assessment, 24-hour 98th percentile PM_{2.5} impacts, the 24-hour PM₁₀ impacts, and the annual and 1-hour 98th percentile NO₂ impacts from the projected field office and cumulative (ozone) oil and gas development estimates. The EA also provides a link to the full CARMMS report that is available to the public for review.

These data sets described in the EA are designed to form “bookends” to account for the potential range of future development (besides the possibility of no development) that could occur on the nominated parcels and the development’s cumulative context.

The EA also provides a climate change assessment which includes the estimated greenhouse emissions associated with the 2021 low CARMMS development scenario, and compares these to the projected 2020 Colorado annual rates as estimated by CDPHE. The EA provides additional information regarding the associated climate impacts by placing into context the cumulative low CARMMS scenario emissions with those from an EPA climate modeling study. The EA discloses the projected climate change impacts likely to occur in the region based on the global emissions scenarios analyzed by the EPA and the broader scientific community. Although one commenter claims these impacts to be significant based on the associated uncertainty, the uncertainty the BLM EA refers to is the level of any potential future development, not the climate changes derived by the best available science. Climate changes are expected to occur regardless of whether or not the nominated parcels are ever leased and/or developed. The climate changes described in the EA are based on the analysis of the entire world’s worth of GHG sources and sinks as projected far into the future. Any potential emissions associated with the future development of the nominated leases alone would not cause significant climate change impacts (See EA Section 4.3.1, EPA study). As described in the EA, potential future development of the leased parcels will incrementally add to the global GHG burden.

Additionally, BLM has added to the EA consideration of estimated downstream CO₂ emissions that were derived from CARMMS LSFO source apportionment emissions inventory production data. The data are provided for informational and comparative purposes only, as BLM cannot predict with certainty what actual development or production potential will be on the nominated parcels or for the field office in general. The CARMMS data provide a potential range of future development impacts for consideration.

CEQ has received extensive comments from the public and other federal agencies on the “Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts”, and therefore this guidance may change before it becomes final guidance for agencies. The EA provides an adequate analysis of emissions and climate change relative to what is known for such effects and scenarios and given the uncertainty about the timing and intensity of any potential future development.

Comments Related to the NEPA Process

Comment: Deferral of the 18 nominated parcels is unwarranted. As one commentator stated: *“With the Sage Grouse RMPA ROD issued, leasing stipulations needed to protect Sage Grouse*

are clearly outlined and are now in formal implementation stage... In this sense, the deferrals are unnecessary and arbitrary lacking a substantive pretext given the RMPA ROD and the agency's ability to apply appropriate lease stipulations if and when leases are actually issued and acquired by an operator."

BLM Response: Section 2.2.2 and 2.3 of the EA describe the deferral of the 18 nominated parcels, stating that the Sage Grouse RMPA ROD was signed on September 21, 2015, but analysis of these lease parcels began before then, so the parcels had to be deferred. To expand on that explanation: In June 2015, all nominated lease parcels were sent to the field office to analyze resource concerns and apply appropriate stipulations. Information about the lease sale, the particular parcels and stipulations, was mailed to all surface owners, and presented to the public for a scoping period from August 10 to September 9, 2015. Thus, resource analysis, application of stipulations, and scoping all occurred before the Sage Grouse RMPA was signed. BLM determined that the 18 parcels could not be appropriately analyzed or scoped before the Sage Grouse RMPA was signed since we could not know the final sage grouse stipulations the RMPA would require. The 18 parcels could not be started after September 15 because the scoping period had already ended, so those parcels would not undergo the full NEPA process. Thus, the parcels have been deferred and may be considered in a future lease sale.

Comment: The Little Snake RMP is inadequate. As one commentor stated: *"The current LSFO 2011 RMP does not address the relatively new and dangerous extraction methods of fracking and horizontal drilling. Nor does it include any analyses of the impacts that potential greenhouse gas ("GHG") emissions of federal fossil fuels (leased and unleased) or fracking and horizontal drilling have on the environment, on BLM sensitive species, on shallow water table and wetlands, or on the increased risks from induced seismic activity. BLM must fully analyze the public health, environmental justice, and industrialization impacts of fossil fuel extraction and especially hydraulic fracturing across the entire LSFO planning area... At the very least, the issue needs to be fully addressed in an Environmental Impact Statement ("EIS") and in an amended Resource Management Plan ("RMP")."*

BLM Response: LSFO RMP EIS Appendix H includes hydraulic fracturing and directional drilling in its explanation of common drilling processes, along with surface casing and cementing to protect usable water. Air quality impacts (including hazardous air pollutants) from oil and gas development are described in LSFO RMP EIS 4.3.1, climate change is discussed in 4.3.1 and 4.6, wetlands in 4.3.3, and sensitive species in 4.3.5 and 4.3.6. The effect of fossil fuel extraction on safety of public land users is addressed in Section 4.4.3, and the effect on environmental justice is analyzed in Section 4.5.

Comment: A full range of alternatives was not considered. As one commentor stated: *"[BLM] must consider a full range of alternatives, including a no leasing alternative and an alternative that disallows new hydraulic fracturing and other unconventional well stimulation activities, and require strict controls on natural gas emissions and leakage."*

BLM Response: This EA included a No Leasing Alternative (the no-action alternative – Section 2.2.1).

The NEPA directs BLM to “study, develop, and describe appropriate alternatives to recommend courses of action in any proposal that involves *unresolved conflicts* concerning alternative uses of available resources” (NEPA Sec102(2)(E)) (*italics added*). As explained in the Hydraulic Fracturing section of comment responses, at the APD stage, drilling plans will undergo site-specific analysis, and COA’s can be added to increase protections during hydraulic fracturing, or restrict the use of this completion technique. In addition, state and federal regulations govern the hydraulic fracturing process. These provide a number of avenues to resolve potential conflicts from hydraulic fracturing, therefore, an alternative disallowing their use is unnecessary at the leasing stage.

Finally, stipulation CO-56, which has been applied to each parcel, allows for supplementary air quality analysis and mitigation when APDs are submitted, and the commentor has not shown what additional analysis is needed and what other “strict controls” on gas emissions should be considered.

Comment: Site-specific analysis is lacking. As one commentor stated: “*BLM has also unlawfully restricted its NEPA analysis by failing to analyze sufficiently site-specific impacts. The PEA impermissibly defers analysis of all site-specific indirect impacts, such as impacts of emissions of regulated air pollutants (including GHGs) associated with the development of oil and gas resources; impacts to groundwater hydrology; impacts to water quality and water quantity; and site-specific mitigation measures to protect fluid mineral sources, soil resources, groundwater and surface water resources, vegetation, special status animals, and other vital resources to the APD (Applications for Permit to Drill) stage.*”

BLM Response: At the lease-sale stage BLM does not yet know 1) if a lease parcel proposed for an oil and gas lease sale will be purchased and result in the issuance of an oil and gas lease; 2) whether an application for permit to drill (APD) will be submitted on a lease that is issued for a proposed lease parcel, and 3) the specific location and operating procedures, such as the use of hydraulic fracturing, for any oil and gas operations that might be proposed in an APD.

As explained in the EA, once a lease has been issued, before oil and gas drilling may occur the proponent for those operations must submit an APD that provides specific details as to the surface and subsurface operations proposed, BLM must analyze the proposal in a site-specific NEPA document, and BLM must provide its approval for the specific oil and gas operations that will occur. Given this multiple-step process for oil and gas development, specific information on the location, affected resources and operating procedures that will be utilized for any future drilling on the parcels is not currently known. Moreover, there is also uncertainty as to whether the parcel possesses economically recoverable fluid mineral resources, and if so, whether those resources are gas, oil or combination thereof. In light of the uncertainties that exist at this time, conducting the site-specific analysis and addressing the issues raised in this comment would require a great deal of speculation and, as a result, offer little information for the decision-maker. The potential impacts of a specific drilling proposal can be more accurately analyzed if and when a site-specific and detailed proposal is submitted.

Comment: An EA and FONSI is not appropriate because the project is highly controversial, has uncertain or unknown risks, and poses risks to public health, safety, and sensitive species. An EIS should be prepared.

BLM Response:The courts have noted that “mere opposition to the project does not in itself create a controversy”, rather, a project is highly controversial if “substantial questions are raised as to whether a project... may cause significant degradation.” (*Center for Biological Diversity, et al. v. Bureau of Land Management, et al.*, 2013 U.S. Dist. LEXIS 52432, 839(N.D. Cal. March 31, 2013).)

Regarding substantial questions, uncertain and unknown risks: As described in the EA, approximately 565,000 acres within LSFO are currently leased, and wells have been drilled within the Cumulative Impacts Analysis Area since 1924 (there are earlier wells in other parts of the Field Office). The Little Snake RMP EIS was incorporated by reference into this EA, which analyzed oil and gas development RFD scenario of 3031 wells. Thus, there is a long history of oil and gas development in the area, and the RMP EIS analyzed far more extensive development than the possible development which could occur on the 813 acres of Parcels 7416 and 7429. The possible risks to public health and sensitive species are minimized by stipulations, federal and state regulations, and COA on development proposals (see comment responses to Vegetation, Hydraulic Fracturing and Wildlife comments), and do not go beyond risks already considered in the RMP EIS.

The uncertainties described in the EA have to do with the inability to do site-specific analysis before APDs are submitted. The courts have found preparation of an EIS is “mandated where uncertainty may be resolved by further collection of data, or where collection of such data may prevent speculation on potential effects.” (*Center for Biological Diversity, et al. v. Bureau of Land Management, et al.*, 2013 U.S. Dist. LEXIS 52432, 839; (N.D. Cal. March 31, 2013).) However, further collection of data before a lease sale will not show with any certainty where wells will ultimately be proposed, the target formations or drilling practices, or other details of site-specific well development proposals, so completing an EIS will not help resolve those uncertainties.

Comments Related to Wildlife Resources

Comment: Parcels 7416 and 7429 should be deferred based on the potential impacts on Columbian sharp-tailed grouse lek sites (4 mile buffer) and winter range. As one commenter noted, “*This grouse is listed as locally imperiled in Colorado and occupies less than 10% of former range. The species is threatened by habitat loss/degradation. Based on the imperiled status of this species it is arbitrary and capricious to offer these parcels for lease sale.*”

BLM Response: The lease parcels are mapped by CPW as CSTG winter range, which, based on most-current telemetry-derived research, generally extends up to 4 miles from their lek of capture (see updated discussion in section 3.4.2.3 Special Status Animals). During the spring through fall months, CSTG remain closely associated with their respective leks, with 80 to 90%

of the birds remaining within 1.2 miles of the lek for all reproductive functions. The updated text in Section 3.4.2.3 details how the lease parcels relate to these seasonal use patterns and the likelihood of impacting these seasonal use activities and associated habitat. Based on the information source cited by the commenters (i.e., NatureServe), the tendency of birds to tolerate disturbance outside the lekking period helps corroborate BLM's assessment of risk.

Comment: The proposed action and EA are grossly deficient in terms of their analysis of and mitigation of impacts to Columbian Sharp-Tailed Grouse ("CSTG"), a BLM sensitive species.

"The only protections for this habitat are a timing limitation on initial drilling (though not production) activities within winter range."

BLM Response: EA Section 3.4.2.3 has been amended to more explicitly detail those habitat features and seasonal use functions that are considered most relevant to lease development, as well as examples of Conditions of Approval that may be appropriate for addressing such concerns once development proposals are tendered.

Comment: *"The EA then concedes that "The potential range and character of fluid mineral influences on CSTG would closely parallel those affecting greater sage-grouse, namely oil and gas development activity and its infrastructure can exert adverse influences on grouse behavior and demographics miles from the source of disturbance... The PEA, for example, contains no discussion or analysis of BLM's own core finding that the continued use of the traditional stipulations proposed here will "substantially influence" grouse populations."*

BLM Response: EA Section 3.4.2.3 has been amended to more clearly explain the relationship between greater sage-grouse and CSTG and the management indicated to maintain the effective habitat base and stable population-level demographics.

Comment: *"Oil and gas development has been linked to population-level impacts on wildlife, including lower reproductive success of sage grouse and declines in the abundance of songbirds and aquatic species. As one commenter stated, "BLM should conduct a full assessment of the direct and indirect impacts of unconventional oil and gas development activities on wildlife and ecosystems through a suite of comprehensive studies on all species and ecosystems that could be affected. The studies should be particularly detailed for federally and state listed species, federal and state candidates for listing, and state species of special concern."*

BLM Response: BLM believes that the current body of literature and management devices used in addressing potential impacts to special status species from fluid mineral development activities are sufficient to address reasonable risk to these species and to identify COAs that may be appropriate to employ depending on specific lease development plans. On the other hand, specific lease development proposals evaluated by BLM and State of Colorado may indicate that further mitigation is warranted, which, in many cases takes the form of operator participation in conducting or funding further study.

Comment: *"Invasive species may be introduced through a variety of pathways that would be*

increasingly common if oil and gas activity is allowed to expand.”

BLM Response: Section 3.4.2.6 was amended to explicitly address aquatic nuisance species.

Comment: *“..open air pits that store waste fluid pose risks for wildlife that may come into contact with the chemicals stored in the pits.”*

BLM Response: Section 3.4.2.2 was amended to explicitly address migratory bird access to fluid storage facilities.

Comment: *“BLM also erroneously failed to complete formal consultation with FWS regarding the heightened risk of spills and leaks that the lease sale poses to endangered fish and their habitat in the Upper Colorado Basin. BLM’s determination that “[t]here is no reasonable likelihood of lease development causing direct impacts” to the endangered fish populations fails to take into account the increased risk of leaks and spills that will occur with increased fluid mineral development. These leaks and spills will pollute nearby streams, rivers, and stream-connected groundwater, exposing endangered fish to toxic pollutants and degrading their habitat.”*

BLM Response: See **Comments Related to Hydraulic Fracturing, Hazardous Materials and Water Quality**. Historical or recent federal oil and gas development have not been implicated as a contaminant source deleterious to endangered fish habitat managed by the Little Snake or White River Field Offices. Because BLM is aware of no information suggesting that developments in these tributary systems far upstream of occupied habitat have delivered contaminants capable of causing injury or mortality to endangered fish in the Yampa River, and there exist a number of regulatory mechanisms and regulations at the State and federal level that have been instituted to prevent such releases, there is no basis for effects determination or complementary Section 7 consultation.

Comment: *“Rather than provide an adequate analysis or “convincing statement of reasons” for why the sale’s effects are insignificant, BLM shirks its obligations under NEPA, relying instead on the USFWS Programmatic Biological Opinion (PBO), which was prepared in 2008 and only generally addresses water depletions associated with fluid minerals development on BLM lands, as a substitute for the required analysis. BLM’s reliance on the PBO is improper as the PBO does not anticipate the full scope of water use potentially required by the oil and gas development that is likely to take place on the parcels. Consequently the PEA fails to address the serious threat to the endangered species.”*

“New information reveals that horizontal drilling, hydraulic fracturing, and other related infrastructure projects in the LSFO planning area will require water depletions “to an extent not previously considered.” Before leasing these lands, BLM must formally consult or reinstate formal consultation regarding the lease sale’s water depletion effects on the endangered fish. Because of the high volume of water required for even a single well that uses unconventional extraction methods, the cumulative water depletion has a significant impact on the endangered species dependent upon water sources that serve to supply oil and gas operations.”

BLM Response: Projected water use attributable to fluid mineral development in the respective BLM Field Offices was calculated by generating an average water use value for drilling and completing a single well (including associated pipeline testing and dust suppression) that represented the various and collective development plays in each Field Office. These average per-well values were multiplied by the projected number of wells drilled annually to derive an average annual depletion figure. These annual depletion values by Field Office were the basis for effects determination in the PBO—not the quantity of water used per well. The adequacy of these projections in the LSFO can be illustrated by comparing the fluid mineral depletion figure analyzed in the PBA/PBO (369 acre-feet per year) to that average depletion amount reported by the Field Office from 2009-2015 (30.7 acre-feet per year or about 8% of that used for PBO analysis). BLM is aware that horizontal drilling techniques generally require much larger volumes of water than development of more conventional vertical or directional wells, but that fact must be viewed in the context of the number of wells required to produce the lease’s resources. As an example, an industry projected the need to develop about 22 horizontal wells to fully access oil and gas reserves on a roughly 7,400 acre lease parcel. In contrast, more conventional development, at 40-acre downhole spacing, would be expected to require in excess of 175 wells. Based on this information, there is no imminent need to reinitiate section 7 consultation for this lease sale based on the inadequacy or exceedance of fluid mineral depletion estimates for LSFO.

Comment: *“Infrastructure development projects, including pipeline and road improvement projects require high amounts of water (up to 29.1 and 9 acre feet of water in 2011, respectively), but the PBO only accounts for water use associated with well production...the PBO must take into account the water depletion of these projects as well.”*

BLM Response: The PBA and PBO depletion calculations accounted for well drilling and completion, hydrostatic pipeline testing, and dust suppression. Hydrostatic testing of larger, interstate transmission pipelines were not considered within the scope of the PBA/PBO and separate consultation is required under these circumstances.

Comment: *“Although the PEA very briefly mentions some potential impacts to these imperiled species, it does not fully evaluate the likelihood of the impacts or the ultimate effects on populations. BLM must provide an analysis of the nature, intensity, and extent of potential impacts, along with supporting science and data...”*

BLM Response: The analysis addresses relevant direct and indirect impacts associated with habitat and behavior and acknowledges the likely scale and duration of effects to the extent possible given the absence of specific development plans. Literature used to support the analysis is referred to in the text.

Comment: *“Oil and gas development, and particularly the practice of fracking, pose an immense threat to water resources. It is inconceivable that fracking could be performed in these valley bottoms without disastrous impacts to the water resources and the native plants and animals that depend on these ecosystems. High volume removal of surface or groundwater can result in damage to wetlands, which rely on ample water supplies to maintain the fragile*

dynamics of a wetland habitat. Damage can also occur from spills of chemicals or wastewater, filling operations, and sediment runoff.”

BLM Response: See **Comments Related to Hydraulic Fracturing, Hazardous Materials and Water Quality**. Most, if not all, of the seasonal wetlands associated with the leases’ uplands (especially 7429) appear to be surface water systems whose sources involve overland flow or localized alluvium. It is considered unlikely that these wet meadow, swale, or vernal pool habitats have any functional continuity with formations targeted for production or injection. Although the draft acknowledges that hydraulic fracturing, injection of produced water, and accidental spills may affect surface and groundwater quality, State and federal regulations provide the means to require inspection and enforcement that substantially minimize this risk (e.g., establishing groundwater monitoring wells, geologic hazard characterization, casing and cementing rules).

Although it may be unreasonable to expect that a surface water monitoring system in, for example, Slater Creek and the William’s Fork River, may be able to detect, much less discriminate the source of, water quality changes attributable to lease development, text has been inserted in section 3.4.2.6 (Aquatic Wildlife, Potential Future Mitigation).