



U.S. Department of the Interior
Bureau of Land Management

Environmental Assessment

DOI-BLM-WY-0000-2024-0006-EA

2025 First Quarter Competitive Lease Sale

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Cheyenne, Wyoming 82009

BLM e-Planning link:

<https://eplanning.blm.gov/eplanning-ui/project/2033626/510>

The BLM's multiple-use mission is to sustain the health and productivity of the public lands for the use and enjoyment of present and future generations. The Bureau accomplishes this by managing such activities as outdoor recreation, livestock grazing, mineral development, and energy production, and by conserving natural, historical, cultural, and other resources on public lands.

DOI-BLM-WY-0000-2024-0006-EA

BLM Wyoming
First Quarter Competitive Oil and Gas Lease Sale
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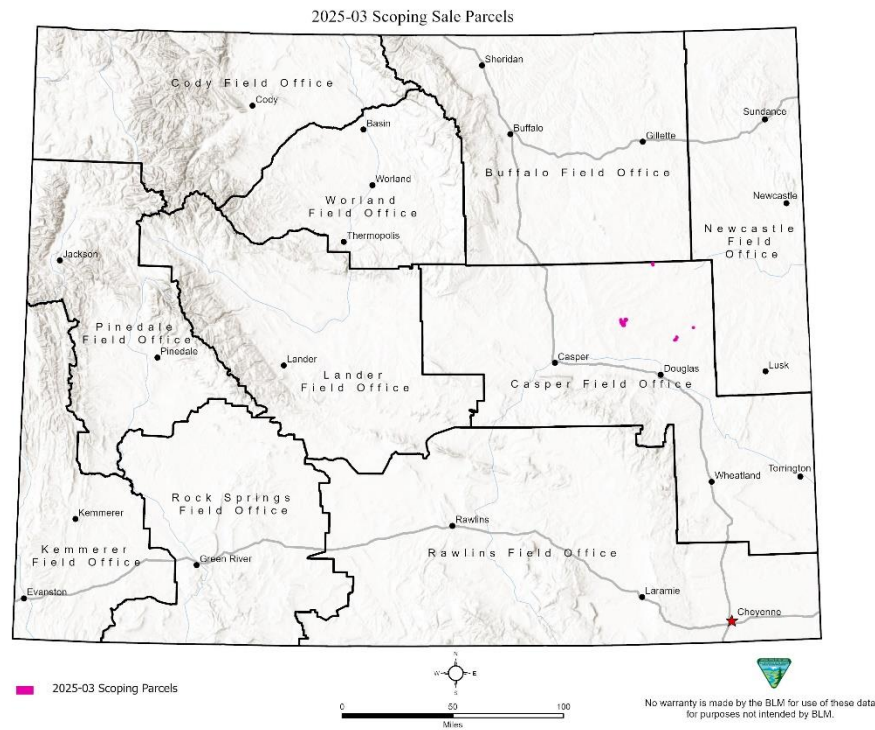
1 Introduction

In accordance with the Mineral Leasing Act of 1920 (MLA), as amended [30 U.S.C. § 181 et seq.], and Title 43 Code of Federal Regulations (CFR) 3120.1-2(a), the BLM Wyoming State Office (WSO) conducts a quarterly competitive oil and gas lease sale for lands that are eligible and available for leasing. A Notice of Competitive Oil and Gas Lease Sale (Sale Notice), which lists parcels to be offered at the auction, will be published by the WSO at least 45 days before each of the subject auction dates. Applicable lease stipulations for each parcel will be identified in the Sale Notices. The decision as to which public lands and minerals are open for leasing and what leasing stipulations may be necessary is made during the BLM's land use planning process in accordance with the Federal Land Policy and Management Act of 1976 (FLPMA) [43 U.S.C. § 1712]. Surface management for mineral extraction on non-BLM administered surface overlying Federal minerals is determined by the BLM in consultation with the appropriate surface management agency or the private surface owner when surface use is proposed by the leaseholder or its designated operator.

After the end of the nomination period, the WSO prepared a draft list of lease sale parcels (the "preliminary parcel list") for this portion of the sale. The WSO submitted the draft list of lease sale parcels to the applicable BLM field and district offices for initial review and processing. Interdisciplinary Teams (IDTs) in each field office, in coordination with their district office, reviewed the parcels to determine 1) if they are located in areas open to leasing under the approved RMP; 2) the appropriate stipulations required under the approved RMP; 3) whether new information or changed circumstances are present since the land use plan was approved; 4) necessary coordination requirements with other Federal or State agencies; and 5) if there are special conditions of which potential bidders should be made aware. The IDT relied on personal knowledge of the areas involved and reviewed existing databases (including Geographic Information System (GIS) data and digital aerial imagery) and file information to determine the appropriate stipulations. Where the BLM personnel determined field visits were necessary, field visits were made to those parcels where the BLM had legal access; results of any onsite visit is documented in the administrative record. No parcels analyzed in this EA required additional site visitation because after IDT review BLM determined existing information was sufficient to support the decision to offer the parcels.

This Environmental Assessment (EA) has been prepared to document compliance with National Environmental Policy Act (NEPA). Recent changes to Council on Environmental Quality (CEQ) regulations implementing the procedural provisions of NEPA reinstated previous definitions concerning direct, indirect and cumulative effects as defined under 40 CFR 1508.1 (g)(3). Potential effects, through implementation of this project, are discussed within this EA. The BLM is aware of the November 12, 2024 decision in *Marin Audubon Society v. Federal Aviation Administration*, No. 23-1067 (D.C. Cir. Nov. 12, 2024). To the extent that a court may conclude that the Council on Environmental Quality (CEQ) regulations implementing NEPA are not judicially enforceable or binding on this agency action, the BLM has nonetheless elected to follow those regulations at 40 C.F.R. Parts 1500– 1508, in addition to the DOI's procedures/regulations implementing NEPA at 43 CFR Part 46, to meet the agency's obligations under NEPA, 42 U.S.C. §§ 4321 et seq.

Figure 1-1. 2025 First Quarter Competitive Lease Sale Parcels



1.1 Background

BLM is responsible for oil and gas leasing on about 700 million acres of BLM, national forest, and other Federal lands, and seeks to ensure that mineral resources are developed in an environmentally responsible manner.

In accordance with the MLA and 43 CFR § 3120.12, the BLM WSO conducts quarterly competitive oil and gas lease sales for lands that are eligible and available. Private individuals or entities may file Expressions of Interest (EOIs) to suggest parcels for consideration for leasing by the BLM. The authorized officer also may identify lands for leasing consideration. Additional information on the competitive lease sale (CLS) process is available on-line at: <https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/leasing>.

The offering and subsequent issuance of oil and gas leases, in and of itself, does not cause or directly result in any surface disturbance. The BLM cannot determine, prior to conducting a lease sale, whether a proposed parcel actually will be leased, or if it is subsequently leased, whether the lease will be explored or developed.

Once a parcel is sold and the lease is issued, the lessee has the right to use the leased lands to explore and drill for all of the oil and gas within the lease boundaries, subject to the stipulations attached to the lease, restrictions derived from specific nondiscretionary statutes, and other reasonable measures to minimize adverse impacts (see 43 § CFR 3101.12). Further, relevant regulations at 43 CFR § 3162.5-1(a) provide: “The operator shall conduct operations in a manner which protects the mineral resources, other natural resources, and environmental quality. In that respect, the operator shall comply with the pertinent orders of the authorized officer and other standards and procedures as set forth in the applicable laws, regulations, lease terms and conditions, and the approved drilling plan or subsequent operations plan. Before approving any Application for Permit to Drill (APD) submitted pursuant to § 3162.3-1 of this title, or other plan requiring environmental review, the authorized officer shall prepare an environmental record of review or an environmental assessment, as appropriate. These environmental documents will be used in determining whether or not an environmental impact statement is required and in determining any appropriate terms and conditions of approval of the submitted plan.” Accordingly, the BLM can subject development of existing leases to reasonable conditions to minimize impacts to other resources, through the application of Conditions of Approval (COAs) at the time of permitting. Any constraints must conform with the applicable land use plan and be consistent with rights granted to the holder under the lease. In addition, upon cessation of lease operations, the lessee must plug

the well(s) and abandon any facilities on the lease. The surface must also be reclaimed to the satisfaction of the BLM authorized officer, in accordance with the MLA, Section 17g [30 U.S.C. § 226(g)].

Oil and gas leases are issued for a 10-year period and continue for so long thereafter as oil or gas is produced in paying quantities. If a lessee fails to produce oil or gas, does not make annual rental payments, does not comply with the terms and conditions of the lease, or relinquishes the lease, the lease may terminate or be cancelled, and BLM may consider offering the lands for lease at another lease sale after a new review process.

1.2 Purpose and Need and Decision to be Made

It is the policy of the BLM as derived from various laws, MLA and FLPMA to make mineral resources available for extraction and to encourage development of mineral resources to meet national, regional, and local needs. Continued sale and issuance of lease parcels in conformance with the approved RMPs would allow for continued production of oil and gas from public lands and reserves.

The need is to respond to Expressions of Interest, as established by the Federal Onshore Oil & Gas Leasing Reform Act of 1987 (FOOGLRA), MLA, and FLPMA.

BLM will decide, based on this analysis, whether to make parcels available for lease and what stipulations will be placed on those parcels, in conformance with the approved RMPs.

1.3 Tiering and Conformance with BLM Land Use Plans and Other Environmental Assessments

Pursuant to 40 CFR § 1501.11, this EA tiers to the Final Environmental Impacts Statements (FEISs) prepared for each Field Office (FO) Resource Management Plan (RMP), and any subsequent amendments or updates, and incorporates by reference the relevant portions of the FEISs. The impacts analysis in the FEISs for the effects from oil and gas leasing and development incorporates the Reasonably Foreseeable Development (RFD) scenarios (i.e., the level of oil and gas development projected for the life of the plan based on historically and projected trends).

The sale and issuance of the leases conforms to the approved RMPs (43 CFR § 1610.5) and Records of Decision (RODs) for the applicable planning areas, as amended or updated, including:

High Plains District (HPD)

The Casper Field Office (CFO) [RMP](#) ROD approved on December 7, 2007 (supported by June 2007 FEIS), updated March 19, 2021, as amended by the Record of Decision and Bureau of Land Management Casper, Kemmerer, Newcastle, Pinedale, Rawlins, and Rock Springs Field Offices Approved Resource Management Plan Amendment ([ARMPA](#)) for Greater Sage-Grouse approved on September 21, 2015 (supported by May 2015 FEIS).

The FO RMPs include allocation decisions which identify lands as either open or closed to fluid mineral leasing, and (if open) provide stipulations that are attached to new leases to mitigate effects of potential development operations.

This EA discloses the affected environment (including the reasonably foreseeable environmental trends and planned actions in the area), analysis of potential impacts not already considered in the EISs to which this EA tiers, and potential mitigation of those impacts. The EA provides information for BLM to determine whether this project would have significant impacts not already disclosed and analyzed in other NEPA documents, warranting an EIS. The RMP EISs have already evaluated potentially significant impacts arising from the BLM's land use planning decisions. See 43 CFR § 46.140(c). Based on this EA, the BLM may issue a "finding of no significant impacts" (FONSI), if no significant impacts are identified. If a FONSI is reached, a Decision Record (DR) may be signed approving the selected alternative, which could be the proposed action, the no-action alternative, or a combination thereof.

1.4 Relationship to Statutes, Regulations, and Other Plans or Decisions

The proposed action and alternatives are consistent with other plans, programs, and policies of other federal agencies, the State of Wyoming, local governments, and affected Tribes, to the extent practical, including but not limited to the following:

- Federal Land Policy and Management Act of 1976, as amended [43 U.S.C § 1701 et seq.]
- Mineral Leasing Act of 1920, as amended [30 U.S.C. § 181 et seq.]
- The National Environmental Policy Act [42 U.S.C. 4321 et seq.]
- Clean Air Act [42 U.S.C. § 1857 et seq.], as amended and recodified [42 U.S.C. § 7401 et seq.] Clean Water Act [33 U.S.C. § 1251 et seq.]
- Endangered Species Act [16 U.S.C. § 1531 et seq.]
- Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low- Income Populations
- Migratory Bird Treaty Act [16 U.S.C. § 703 et seq.] National Trails Systems Act [16 U.S.C. § 1241 et seq.]
- National Landscape Conservation System Act [16 U.S.C. § 7202]
- National Historic Preservation Act of 1966, as amended [54 U.S.C. § 300101 et seq.] Protection of Historic Properties (36 CFR § 800)
- Native American Graves Protection and Repatriation Act of 1990 [25 U.S.C. § 3001 et seq.] and 43 CFR § 10 American Indian Religious Freedom Act of 1978 [42 U.S.C. 1996]
- Native American Trust Resource Policy standards are presented in the Department of the Interior Comprehensive Trust Management Plan dated March 28, 2003
- Wild and Scenic Rivers Act of 1968, as amended [16 U.S.C. § 1271 et seq.]
- Bald and Golden Eagle Protection Act of 1940, as amended [16 U.S.C. § 668 et seq.] Paleontological Resources Preservation Act of 2009 [16 U.S.C. §470aaa et seq.]
- Greater Sage-grouse Record of Decision and Land Use Plan Amendments and Revisions for the Rocky Mountain Region, 2015 (United States Department of Agriculture, Forest Service)
- USFS Supplemental Information Report to the Biological Assessment and Evaluation for Revised Land and Resource Management Plans and Associated Oil and Gas Leasing Decisions, 2018

1.5 Scoping

To identify preliminary issues for analysis (refer the BLM's NEPA Handbook H-1790-1 at page 41), the BLM conducted internal scoping. The BLM personnel listed in Appendix 5.4.2 provided information and input for this EA. Through the BLM's internal scoping, and in light of the numerous EAs the BLM has prepared for oil and gas lease sales in Wyoming, this EA incorporates by reference the analysis of issues previously addressed in the RMP FEISs, to which it tiers.

BLM Wyoming personnel also conferred with the Wyoming Game and Fish Department (WGFD) in accordance with an interagency Memorandum of Understanding.

In addition, BLM conducted a 30-day public scoping period which began on July 18, 2024. The main issues identified through public scoping included, but were not limited to, leasing in Greater Sage-Grouse habitat, big game habitat and migrations corridors, potential emissions impacts, water resources, expressions of interest, and support for continued leasing. Comments received through the public scoping process were incorporated into this document.

1.6 Public Participation

Formal public participation was initiated when the original parcel list (4 parcels) was posted to the ePlanning database on July 18, 2024 (<https://eplanning.blm.gov/eplanning-ui/project/2033626/510>). A news release was issued on July 18, 2024, notifying the public that the parcels were being posted for a 30-calendar day public scoping period. A news release was issued on October 4, 2024, notifying the public that this EA was being posted on the BLM Wyoming website for a 30-calendar day public comment period. As required by BLM leasing policies, where parcels include split estate lands, the BLM WSO sent notification letters to the surface owner(s) identified by the party submitting the EOI.

In November 2021, the Department of the Interior released a Report on the Federal Oil and Gas Leasing Program (Report). The Report made specific recommendations to address documented deficiencies in the program to meet three programmatic goals:

- Providing a fair return to the American public and States from Federal management of public lands and waters, including for development of energy resources;
- Designing more responsible leasing and development processes that prioritize areas that are most suitable for development and ensure lessees and operators have the financial and technical capacity to comply with all applicable laws and regulations; and
- Creating a more transparent, inclusive, and just approach to leasing and permitting that provides meaningful opportunity for public engagement and Tribal consultation.

The Report also recommends: As an overarching policy, BLM should ensure that oil and gas is not prioritized over other land uses, consistent with BLM's mandate of multiple-use and sustained yield. The BLM should carefully consider what lands make the most sense to lease in terms of expected yields of oil and gas, prospects of earning a fair return for U.S. taxpayers, and conflicts with other uses, such as outdoor recreation and wildlife habitat. The BLM should always ensure it is considering the views of local communities, Tribes, businesses, State and local governments, and other stakeholders. While the leasing decisions for this lease sale result from the BLM's exercise of its discretion based on its analysis and review of the record, they are also consistent with the recommendations in the Report, as well as numerous reports issued by the Governmental Accountability Office and Congressional Budget Office, including: ensuring public participation and Tribal consultation, addressing conflicts with other resources, avoiding lands with low potential for oil and gas development, focusing leasing near existing development and ensuring a fair return to taxpayers. This lease sale and NEPA process includes a 30-day scoping period, 30-day comment period on the environmental assessment. The BLM has also ensured applicable Tribal consultation is current. The BLM's leasing decisions will take into account public comments received during this process and will further evaluate points raised in any protests received.

Oil and Gas Program Administration:

As the steward of onshore Federal energy resources, including deposits of oil and gas, the BLM is responsible for balancing conservation, energy production, and generating a fair return to the public for the extraction of public resources. Revenue from Federal oil and gas development is distributed to several Federal programs, as well as being shared with the States in which the oil and gas development occurs. At the same time, energy development can pose significant risks to the environment. The BLM is charged with balancing these competing considerations in a manner that best serves the public interest.

For all competitively issued leases, the Mineral Leasing Act (MLA) requires a royalty "at a rate of not less than 12.5 percent in amount or value of the production removed or sold from the lease." 30 U.S.C. § 226(b)(1)(A); see also 30 U.S.C. § 352 (applying that requirement to leases on acquired land). Although the BLM is authorized by the MLA and its implementing regulations (43 C.F.R. 3103.3-1(a)(2)(ii)) to specify a royalty rate higher than 12.5 percent for competitive leases, the MLA sets a flat 12.5 percent royalty rate for noncompetitive leases. 30 U.S.C. § 226(c); 30 U.S.C. § 352 (acquired lands).

On August 16, 2022, the Inflation Reduction Act (Act) was signed into law. Section 50262 discusses how this Act affects oil and gas leasing and the fees associated. Of those fees and topics addressed in the Act, any fees associated with royalty rates, minimum bid amount (from \$2 per acre to \$10 per acre), annual rental amounts, reinstatements, reinstatement rental fees, expression of interest (EOI), do not impact the analysis of this EA. The minimum bid amount and the royalty rates increases are addressed within the EA. For the minimum bid amount, 49% of the total amount per parcel is provided to the state, while the federal government retains 51%. For royalty rates, the new rate is 16.67%. This is split equally between the state (8.335%) and the federal government (8.335%). The opportunity to acquire a noncompetitive lease was also removed under the Act.

In addition, the Act also included language regarding the issuance of a right-of-way for wind or solar energy projects. The Act (Section 50265) states, "the Secretary may not issue a right-of-way for wind or solar energy development on Federal land unless (A) an onshore lease sale has been held during the 120-day period ending on the date of the issuance of the right-of-way for wind or solar energy development; and the sum total of acres offered for

lease in onshore lease sales during the 1-year period ending on the date of the issuance of the right-of-way for wind or solar energy development is not less than the lesser of (i) 2,000,000 acres; and (ii) 50 percent of the acreage for which expressions of interest have been submitted for lease sales during that period...” To be in compliance with Sec. 50265 of the Act, BLM must have held an onshore oil and gas lease sale within the previous 120 days prior to issuance of a wind or solar right-of-way. In addition, either a sum total of 2,000,000 acres or 50% of the acreage nominated through expressions of interest (whichever is lesser) must be offered for sale through the competitive lease sale process. BLM is in the process of completing guidance in order to calculate/report these numbers.

1.7 Issues Identified for Analysis

Analysis issues include resource issues that could potentially be affected by oil and gas leasing. The BLM focuses its analysis on changes to the human environment from the proposed action or alternatives that are reasonably foreseeable and have a reasonably close causal relationship to the proposed action or alternatives, including those effects that occur at the same time and place as the proposed action or alternatives and may include effects that are later in time or farther removed in distance from the proposed action or alternatives (40 CFR 1508.1(g)). Consistent with 43 CFR § 3120.31 and § 3120.4-1, the BLM identified site-specific resource concerns and lease stipulations for proposed parcels through a preliminary review process conducted prior to a public scoping period. The following resources/issues are analyzed in detail in this EA:

Greenhouse Gases

How would future potential development of leases contribute to greenhouse gas (GHG) emissions and climate change?

Water Resources

What are the effects of potential oil and gas development, including hydraulic fracturing, on parcels that may be offered for lease on surface and groundwater quality and quantity?

Greater Sage-Grouse

What are the effects to sage-grouse habitats and populations if the parcels nominated for the First Quarter 2025 lease sale are leased and subsequently developed for oil or gas production?

Big Game Species

What are the effects from potential oil and gas development on parcels that may be offered for lease to big game habitats and populations within state identified crucial winter range and designated migration corridors?

Lands with Wilderness Characteristics

What are the effects of potential oil and gas development, including hydraulic fracturing, on parcels that may be offered for lease to lands with wilderness characteristics?

Socioeconomics, Environmental Justice (EJ), and Public Health and Safety

What are the socioeconomic, environmental justice, and public health and safety effects of potential oil and gas development, including hydraulic fracturing, on parcels that may be offered for lease?

1.8 Issues Eliminated from Further Analysis

Based on a review of the context and scale of the Proposed Action, the BLM has considered and eliminated the following issues from further analysis, with justifications provided. The following resources/issues are either not present or did not warrant detailed analysis and not considered in this EA: lands and realty conflicts, locatable and saleable minerals, forest and woodland, cave and karst resources, wilderness study areas, Master Leasing Plans, and wild and scenic rivers. Other resource issues BLM considered but eliminated from further analysis due to environmental impacts previously analyzed through prior NEPA reviews and/or lease notices or stipulations that were applied to avoid and minimize impacts are discussed below:

Cultural and Heritage Resources

Cultural and Heritage resources include traditions cultural properties and historic trails. All parcels addressed in this EA have the potential to contain surface and buried archaeological materials or may be in an area which could affect the setting of known or unknown historic sites, and/or Traditional Cultural Properties (TCPs). Once the decision is made by the lessee to develop a lease, an area-specific cultural records review would be completed to determine if there is a need for a cultural inventory of the areas of proposed surface disturbance. Generally, a cultural inventory will be required before new surface disturbance and all historic and archaeological sites that are eligible for listing in the National Register of Historic Places would be either avoided by the undertaking, have adverse effects to sites minimized or mitigated, or have the information in the sites extracted through archaeological data recovery.

The application of lease terms, cultural resource lease stipulations and the cultural resource lease notices (See Appendix 5.1 for parcels with specific cultural resource stipulations and/or paleontological stipulations. In addition, Lease Notice No. 2, and Lease Stipulation HQ-CR-1) at leasing provides protection to cultural and heritage resources, paleontology, traditional cultural properties, and historic trails. The BLM will not approve any ground disturbing activities that may affect such properties or resources until it completes its obligations associated with the stipulations that are applied to each respective parcel as well as applicable requirements of the National Historic Preservation Act and any 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.

Paleontology

The application of lease terms and the paleontological lease notices (Appendix 5.1) at leasing provides protection to paleontological resources. Leased lands that fall into this category could require professional assessment which may include a field survey prior to surface disturbance. The results of the assessment and survey by a BLM-permitted paleontologist will serve as the basis for a mitigation plan during development. If the inventory resulted in the identification of paleontological resources, mitigation measures may include avoidance, professional monitoring or spot checking, development of an Unanticipated Resource Discovery Plan, and salvage. These mitigation measures would be initiated by BLM and the operator.

Soils

The act of offering, selling, and issuing federal oil and gas leases does not produce impacts to soils. Prior to authorization of surface disturbance on a lease, the BLM will require the lessee or their designated operator to submit a Surface Use Plan of Operations to the BLM. The requirements in the BLM-Wyoming Reclamation Policy would be implemented for all surface-disturbing activities. Stabilization and reclamation of disturbed areas (both interim and final) will be required, in accordance with 43 CFR § 3171. Site-specific, ground-truthed soils data will be provided if and when any associated ground-disturbing activity (drill pad construction or pipeline installation) is proposed. As required in the applicable RMPs, surface disturbance may be restricted or prohibited on steep slopes and within floodplains. Lease Notice No. 1 addresses surface disturbance on slopes greater than 25 percent and is applied to all parcels. Additional stipulations to protect soils can be found in Appendix 5.1.

Vegetation

Vegetation resources will not be impacted to the degree that will require detailed analysis in this EA. This proposed sale and issuance of an oil and gas leases would not authorize any ground disturbances which could affect vegetation resources. Leasing is an administrative action that does not result in any surface disturbance. Site-specific effects cannot be analyzed until an exploration or development application is received, after leasing has occurred. There would be no impacts to vegetation resources through sale of leases. There is some expectation that exploration or development could occur, at which time additional NEPA would be conducted should an APD be filed. The applied lease stipulations and notices will notify buyers during sale of leases which resources may be present, allow the opportunity to adjust the location of potential development at the site-specific level when an APD is received to minimize impacts and ensure impacts are addressed.

Future development proposals on the leases would be subject to the standard lease terms, and all applicable laws, regulations in existence at the time of lease issuance.

Visual Resources

BLM is required to manage for visual resources on BLM owned surface lands. Each RMP contains Visual Resource Management (VRM) requirements and considerations specific for the geographical location to which they apply. VRM practices and standards will be implemented consistent with the respective RMP they are subject to. New oil and gas development would implement, as appropriate for the site, Best Management Practices (BMPs) to maintain visual qualities where possible. This includes, but would not be limited to, proper site selection, reduction of visibility, minimizing disturbance selecting color(s)/color schemes that blend with the background and reclaiming areas that are not in active use. Repetition of form, line, color and texture when designing projects would reduce contrasts between landscape and development. Where applicable, VRM lease stipulations are applied to the proposed parcels in conformance with the approved RMPs (Appendix 5.1). The application of a stipulation would be sufficient at the leasing stage to notify operators that additional measures may be necessary to reduce visual impacts from potential future development (at the APD stage). This provides for the protection and conservation of the visual resources on public lands, as classified by FLPMA regarding BLM- authorized activities.

Recreation

No direct impacts to recreational opportunities would occur as a result of offering leases for sale. The leasing action would be considered in compliance with all relevant recreation regulations, protocols and policies. Impacts on recreation from potential future exploration and development would be analyzed at the APD stage and included design features, and mitigation would be integrated to avoid or minimize potential impacts to recreation consistent with the RMP for the respective planning area.

Fish and Special Status Species (Plants and Vertebrate and Invertebrate Wildlife)

The BLM screened parcels for plants and wildlife species which may be impacted if a lease parcel is sold and subsequently developed. Stipulations were applied to parcels that contain habitat for these species according to the field office RMP (see Appendix 5.1). BLM also reviewed each proposed lease parcel for special status species and threatened and endangered species (see next three paragraphs for further detail).

Threatened and Endangered Species

In additions to the appropriate RMP stipulations, the BLM applies HQ-TES-1 to all parcels (see Appendix 5.1), which states that the 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. The 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. At this time, none of the proposed parcels contain designated critical habitat for any of the threatened or endangered species in Wyoming. However, all parcels are located in an 'area of influence' as designated by the U.S. Fish and Wildlife Service. Any surface disturbing activities that may be proposed on any of these parcels (if sold) will be further evaluated for impacts to T&E species at the time of proposal.

Special Status Species

The Federal Land Policy and Management Act of 1976, Section 102.8, requires environmental resources to be managed to provide food and habitat for fish and wildlife. The Sikes Act instructs agencies to develop, maintain, and coordinate programs for the conservation and rehabilitation of wildlife, fish and game (16 U.S.C. § 670 et seq., section 670h). The DOI Manual 632 and BLM Manual 6840 requires conservation of special status species and the ecosystems upon which they depend on BLM-administered lands. BLM special status species are those listed or proposed for listing under the ESA, and species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA. Instructional Memorandum No. WY IM-2010-027 provides the plant and wildlife Species lists for BLM- administered public lands in Wyoming and these species have been evaluated for potential impacts from the proposed lease sale, as documented by stipulations found in Appendix 5.1 of this EA.

Parcels proposed for lease may contain habitat for sensitive species. Leasing of the proposed parcels would not, by itself, authorize any ground disturbance; however, the proposed lease sale has the potential to impact habitat through future oil and gas development. Although site-specific effects cannot be analyzed until an exploration or development application is received, attachments of stipulations and notices to leases will assure the opportunity to

make adjustments, such as design modifications, at the site-specific level when an Application for Permit to Drill is received, to address specific wildlife and plant resources.

Solid and Hazardous Wastes

None of the parcels are known to contain open sources of solid waste. Historical management of split estate lands is unknown but unlikely to contain reportable levels of hazardous waste; these lands may have been impacted through normal everyday living including but not limited to spills of oils, paints, etc.

Several parcels have been previously leased and contain well bores that have been plugged and abandoned or are active injection wells. Any of these parcels may also contain previously approved for abandonment, oilfield materials in the subsurface; they may also contain materials that were disposed of without authorization.

Should a parcel be leased and developed, generation and temporary storage of waste materials would likely occur. Waste materials would be managed in accordance with 43 CFR § 3171 and 3177, the Resource Conservation and Recovery Act (RCRA), applicable WDEQ regulations, and Wyoming Oil and Gas Conservation Commission (WOGCC) rules. Fluid handling would be evaluated at the development stage and fluids associated with any subsequent drilling, completions and/or production would either be treated, evaporated, or transferred to a WDEQ-authorized commercial treatment, storage, or disposal facility; solids would be treated on site or transferred to a WDEQ-authorized facility. BMPs, SOPs and site-specific mitigation may be applied at the APD stage as COAs.

Grazing

Some of the parcels are located within livestock grazing allotments or private pastures. Leasing or production activities would not cause changes to grazing permit terms and conditions. Any activity that involves surface disturbance or direct resource impacts would have to be authorized as a lease operation through future NEPA analysis, on a case-by-case basis, at the APD stage. Impacts to livestock grazing may occur as a result of subsequent actions including exploration development, production, etc. Therefore, reclamation provisions/procedures including re-vegetation (utilizing appropriate seed mix based on the ecological site, elevation, and topography), road reclamation, range improvement project replacement/restoration (e.g., fences, troughs and cattle guards), noxious weed control, would be identified in future NEPA/decision documents on a case-by-case basis (at the APD stage). In addition, if any range improvement projects could be impacted by wells or associated infrastructure, well pads could be moved 200 meters to avoid rangeland improvements or vegetation monitoring plots as per 43 CFR § 3101.12. BMPs, SOPs and site-specific mitigation may be applied at the APD stage as COAs.

Geology and Mineral Resources

Oil and gas exploration could lead to an increased understanding of the geologic setting, as subsurface data obtained through lease operations may become public record. This information promotes an understanding of mineral resources as well as geologic interpretation. While conflicts could arise between oil and gas operations and other mineral operations, these could generally be mitigated under 43 CFR § 3101.12 and under standard lease terms (see Appendix 5.1) where siting and design of facilities may be modified to protect other resources.

Depending on the success of oil and gas drilling, non-renewable natural gas and/or oil would be extracted and delivered to market. Production would result in the irretrievable loss of these resources. Oil and gas development can usually be managed to avoid or work within other mineral resources. Mining claims and Mineral Materials were reviewed and no parcels have active gravel pits or commercial rock quarries within their boundaries and none are located within a Known Sodium Lease Area.

At the time of a site-specific proposal for development of the lease, Standard Lease Stipulation No. 3 protects the prior rights:

Operations will not be approved which, in the opinion of the authorized officer, would unreasonably interfere with the orderly development and/or production from a valid existing mineral lease issued prior to this one for the same lands.

The oil and gas lessee would conduct its operations, so far as reasonably practicable, to avoid damage to any known deposit of any mineral for which any mining claim is located. The lessee would be required to not endanger or

unreasonably or materially interfere with any mining claimant's operations, including any existing surface or underground improvements, workings, or facilities that may have been made for the purpose of mining operations. The provisions of the Multiple Mineral Development Act (30 U.S.C. § 521 et seq.) will apply to the leased lands as well as any applicable oil and gas EIS.

Designated Development Areas (DDAs)/Oil and Gas Management Areas

Designated Development Areas and Oil and Gas Management Areas are managed primarily for oil and gas exploration and development. None of the parcels are located within a Designated Development Area (DDA). The respective field office's Approved RMPs designates these areas for development incorporating almost all lands with moderate to high oil and gas potential. Potential for future mineral development is primarily limited to lands in the Designated Development Areas which do not conflict other resources.

Areas of Critical Environmental Concern (ACECs)

Areas of Critical Environmental Concern are identified during the RMP process. Parcels offered for sale are subject to the stipulations shown in Appendix 5.1, which includes protecting the relevant and important ACEC values. Should a parcel be sold, and subsequently developed, any further mitigation measures to reduce impacts would be applied at the site-specific project level.

2 Description of Alternatives, Including Proposed Action

Leasing is generally a three-step process. First, the BLM issues a RMP, as required by FLPMA, assessing the resources in a given area and determines what lands to open for development (43 CFR § 1601.0-5(n)). Step two, after the RMP has been signed, is to identify parcels eligible for lease, subject to public protest, and hold a competitive lease sale at which parcels are auctioned off and sold to the highest bidder (see 43 CFR § 3120.13, 43 CFR § 3120.51, 43 CFR § 3120.53). For the third and final step, after leases are issued, the lessees submit proposals to develop the leases. Prior to any surface disturbance occurring, an Application for Permit to Drill (APD) must be submitted and approved (43 CFR § 3162.3-1) by the field office. For each APD, the Bureau determines whether to approve the proposals and what conditions to impose (30 U.S.C. § 226(g) and 43 CFR § 3162.3-1).

BLM developed a parcel list of nominated lands from EOIs and the WSO created a shapefile of all parcels. The shapefile is used in the ArcGIS® mapping program (ArcMap®). Once the shapefile of parcels is created, the shapefile and parcels list are forwarded to BLM WSO specialists and field offices for further review and posted to ePlanning for scoping.

Using GIS, WSO screens all parcels to determine which parcels move forward for further review by the field offices. Each field office (FO) with potential parcels within its boundaries receives a list to review containing only those parcels.

The WSO specialists and the FO's use the same ArcMap® system to screen the proposed parcels. This screen is based on the RMP decisions in each FO. The FO reviews the potential parcels and recommends; which lands need to be removed from further consideration (e.g. lands unavailable for lease due to RMP decisions); which lands need to be deferred (potential conflicts that may have arisen); and leasing stipulations (based on RMP decisions). These recommendations are forwarded to the district offices.

The district office (DO) staff compiles all parcels within the district and verifies the recommendations from each FO within the district. Any discrepancies are discussed between the FO and DO staff to resolve those issues. The DO then sends the compiled list back to the WSO, specifically the fluid minerals staff.

The fluid minerals staff then compiles all three DO recommendations and potential parcels back into one list. The State Director (SD) and the District Managers (DMs) then coordinate and discuss the recommendations and concur on which potential parcels, or portions of parcels move forward for analysis and inclusion into the quarterly CLS EA.

The WSO fluid minerals staff prepares the EA and posts it on the ePlanning website for a 30-day public comment period. After the 30-day public comment period, the fluid minerals staff reviews and responds to the comments and

makes changes to the EA, if necessary. Any major conflicts identified are discussed with the SD and Deputy State Director (DSD) for Lands and Minerals (and other staff if determined necessary by the SD) for a decision on whether to delete, defer or move the parcel forward.

The public comments and responses are then posted on the ePlanning website. The WSO publishes a Notice of Competitive Oil & Gas Lease Sale (Sale Notice), beginning a 30-day protest period. After the 30-day protest period, the fluid minerals staff reviews the protests and prepares responses. Once the protest responses are completed, the fluid minerals staff sends the EA, FONSI, Response to Public Comments, Response to Protests and Decision Record (DR) to other WSO staff for review and comment. These reviews are typically obtained from the Planning and Environmental Coordinator(s), Branch Chiefs, DSDs and finally the SD. The SD typically signs the FONSI and DR the day prior to the CLS. At any point in the review process (up until the day the sale is held), parcels or portions of parcels may be deleted or deferred.

2.1 Alternative 1 – No Action Alternative

Under the Alternative 1, BLM Wyoming would not offer the 4 parcels nominated and located in areas open to leasing under the approved RMPs, containing approximately 2,443.11 acres. This would mean that the Expressions of Interest would be rejected, and the lease parcels would not be offered. Choosing the No Action alternative would not prevent future leasing in these areas consistent with land use planning decisions and subject to appropriate stipulations, identified in the respective land use plans.

2.2 Alternative 2 – Proposed Action

The decision as to which public lands and minerals are open for leasing and what leasing stipulations may be necessary is made during the land use planning process. Surface management/use for mineral extraction on non-BLM administered land overlaying federal minerals will be determined by the BLM in consultation with the appropriate surface management agency or the private surface owner at the time such surface use is proposed by the leaseholder or designated agent. Under the MLA, issuing oil and gas leases is a discretionary authority conveyed to the Secretary of the Interior. In this alternative, BLM would not defer any parcels in accordance with the expression of interest leasing preference (43 CFR § 3120.32) and Instruction Memorandum (IM) 2023-007 - Evaluating Competitive Oil and Gas lease Sale Parcels for Future Lease Sales.

The parcels proposed are detailed in the tables below, Section 4.3, and in Appendix 5.1. No parcels are proposed for deletion or deferral.

Table 2-1. Summary of parcels deferred, deleted, and those proposed to be made available for sale

FIELD OFFICE	NOMINATED ACRES	PARCEL COUNT	WHOLE DEFERRAL	PARTIAL DEFERRAL	DELETE WHOLE	DELETE PART	OFFERED PARCELS (ACRES)
Buffalo (BFO)	0.00	0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Casper (CFO)	2,443.11	4	0 (0)	0 (0)	0 (0)	0 (0)	4 (2,443.11)
Newcastle (NFO)	0.00	0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Cody (CYFO)	0.00	0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lander (LFO)	0.00	0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Worland (WFO)	0.00	0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Kemmerer (KFO)	0.00	0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

FIELD OFFICE	NOMINATED ACRES	PARCEL COUNT	WHOLE DEFERRAL	PARTIAL DEFERRAL	DELETE WHOLE	DELETE PART	OFFERED PARCELS (ACRES)
Pinedale (PFO)	0.00	0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rawlins (RFO)	0.00	0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rock Springs (RSFO)	0.00	0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Total	2,443.11	4	0 (0)	0 (0)	0 (0)	0 (0)	4 (2,443.11)

Under Alternative 2, 4 parcels containing approximately 2,443.11 acres would be offered for lease during the First Quarter 2025 (2025-03) Competitive Lease Sale. Parcels were evaluated for RMP conformance, including but not limited to sage grouse prioritization, and subsequently screened using the five leasing preference criteria listed in 43 CFR § 3120.32 as well as IM-2023-007 and further described its associated attachment (Guidelines for Evaluating Nominated Lease Parcels and Recording Preferential Status in NFLSS) of the IM. The preference criteria are comprised of:

1. Proximity to existing oil and gas development, giving preference to lands upon which a prudent operator would seek to expand existing operations;
 - Proximity to existing development includes proximity to active wells or other types of oil and gas infrastructure (i.e., development, excluding pipelines and access roads, within five miles of the exterior boundary of the parcel), or where federal mineral estate is potentially being drained of the federal resource. Any nominated parcel subject to immediate drainage or within five miles of existing development will be considered to have a preference value of HIGH for this criterion.
2. The presence of important fish and wildlife habitats or connectivity areas, giving preference to lands that would not impair the proper functioning of such habitats or corridors;
 - All EOI lands for which oil and gas development would have a high potential for conflict with important habitats, as well as all nominated lease parcels that are within identified and existing migration areas and connectivity areas, will have a preference value of LOW for this criterion.
3. The presence of historic properties, sacred sites, or other high value cultural resources, giving preference to lands that do not contribute to the cultural significance of such resources;
 - EOI lands for which a parcel contains known cultural resources, such as historic properties protected under the National Historic Preservation Act (NHPA), and/or other cultural resources protected under the American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Executive Order 13007, or other statutes and executive orders, or where Tribes have identified the presence of Traditional Cultural Properties, sacred sites, or other properties of religious or cultural significance, will be evaluated for potential conflict. All parcels that have high potential of conflict with cultural resources will automatically have a preference value of LOW for this criterion.
4. The presence of recreation and other important uses or resources, giving preference to lands that do not contribute to the value of such uses or resources; and
 - EOI lands with existing resources or uses that would not be compatible with oil and gas development automatically will have a preference value of LOW for this criterion.
5. Potential for development, giving preference to lands with high potential for development.

- Potential for development is based on the BLM Office’s Reasonably Foreseeable Development (RFD) scenario where the RFD contains projections of the number of possible oil and gas wells that could be drilled and produced within each of the development potential areas specified as Very High, High, Moderate, Low, and Very Low development potential. Any nominated parcel that falls within Very High or High in the RFD will have a preference value of HIGH for this criterion. Specialists may consider site-specific changes that may have occurred since the Resource Management Plan was initiated/signed and will address and identify the preference value of parcels with Moderate development potential on a case-by-case basis.

Proposed parcels with a high preference value will be considered first for potential inclusion in a lease sale. The BLM will defer lease parcels with a low preference value (Table 2-3). Throughout the review period for the lease sale, BLM may also consider additional measures and deferrals to address the potential impacts of leasing, as well as new information that is presented during the NEPA process for the lease sale.

In accordance with the expression of interest leasing preference (43 CFR § 3120.32) and IM 2023-007, the BLM WY State and Field offices evaluated sale parcels as shown in Table 2-2. None of the parcels have a low preference for leasing based on evaluation criteria 1 through 5 of the IM and RMP requirements. If a parcel is recommended for deferral under one of these criteria, the table indicates which criteria. For example, if the parcel is recommended for deferral based upon sage-grouse prioritization, it meets the requirements under Leasing Preference Criteria #2 due to RMP prioritization requirements. However, if the parcel is recommended for deferral due to migration corridors, it meets Leasing Preference Criteria #2 and the recommendation would be to ‘Defer for leasing preference, Criteria 2 – GSG Habitat/ Connectivity’. It is important to note that if a parcel is deferred under the Greater Sage-Grouse prioritization process (which occurs prior to the screening for the leasing preference), it would also meet the ‘Low’ leasing preference criteria; however, it would be listed as ‘Low (GSG Prioritization)’ and not due to the IM preference criteria. Parcels in criteria 5 (RFD) were evaluated utilizing the best available information from the RMP RFDs, as well as a development potential map created by BLM specialists utilizing publicly available data through the Wyoming State Geological Survey and the Wyoming Oil and Gas Conservation Commission, existing federal oil and gas leases, federal units, participations areas, and well data from the Wyoming Oil and Gas Conservation Commission to screen for development potential.

Table 2-2. Leasing Preference

Office	Parcel WY-2025-03-	1 Proximity Criteria	2 Habitat Criteria	3 Cultural Resources Criteria	4 Other Resources Criteria	5 RFD Criteria	High Preference for Leasing	Low Preference for Leasing
CFO	1926	H	H	H	H	H	X	
CFO	1927	H	H	H	H	H	X	
CFO	2006	H	H	H	H	H	X	
CFO	7319	H	H	H	H	H	X	

2.3 Alternatives Considered but Not Analyzed in Detail

Offer All Nominated Parcels as Originally Submitted Through the Expression-Of-Interest (EOI)

Offering all 4 nominated parcels as originally submitted through the EOI process was considered as an alternative to analyze all nominated lands. This alternative was not analyzed in detail because the offering all parcels would not be in conformance with the RMP(s).

Offer All Nominated Parcels Subject to Standard Lease Terms and Conditions

Offering all nominated parcels with only the standard lease terms and conditions on the BLM’s lease form was considered to reduce constraints to oil and gas development on public lands. Such an alternative is not in conformance with the approved RMPs where the applicable RMP prescribes stipulations in accordance with FLMPA’s Section 102(a)(8) mandate to manage the public lands to protect resource values. Therefore, this alternative was not analyzed in detail.

Offer All Available Parcels Subject to No Surface Occupancy (NSO) Stipulations

An alternative was considered that would offer all parcels located in areas open to leasing with a NSO stipulation. This alternative was not carried forward to detailed analysis because it is not in conformance with the approved RMPs and would only prohibit surface occupancy for oil and gas development; other non-oil and gas occupancy may not be similarly constrained. This alternative would unnecessarily limit oil and gas occupancy in areas where the approved RMPs have determined that less restrictive stipulations would adequately mitigate the anticipated impacts under our mandate of multiple-use and sustained yield.

Defer All Sage-Grouse Habitat Parcels

An alternative was considered that would defer all Greater Sage-Grouse GHMA and PHMA parcels. Under this alternative no parcels would be offered during a competitive oil and gas lease sale. This alternative was not analyzed in detail because the ARMPA allows for leasing in both GHMA and PHMA and it would be the same analysis as Alternative 1.

3 Affected Environment

Introduction

The sale of parcels and issuance of oil and gas leases is an administrative action. Nominated parcels are reviewed under the approved RMP, and stipulations are attached to mitigate any known environmental or resource conflicts that may occur on a proposed lease parcel. On-the-ground impacts would not occur until a lessee or their designated operator applies for and receives approval to undertake surface-disturbing lease actions.

The BLM cannot reasonably determine at the lease offering stage whether a nominated parcel will actually be leased, or if leased, whether or not the lease would be explored or developed or at what intensity development may occur.

The uncertainty that exists at the time the BLM offers a lease for sale includes factors that will affect potential impacts, such as: well density; geological conditions; development type (vertical, directional, horizontal); hydrocarbon characteristics; equipment to be used during construction, drilling, production, and abandonment operations; and potential regulatory changes over the life of the 10-year primary lease term.

If lands are offered, leased, and a proposal for site-specific lease operations is received by the BLM, additional NEPA compliance documentation and technical analysis would be prepared by the BLM. Aside from the applicable protection measures required under the lease stipulations (see Appendix 5.1), additional mitigation may be applied as COAs at that time to mitigate identified impacts.

As described in Section 1.3, above, this EA tiers to the applicable RMP FEISs (40 CFR § 1502.20). In the impacts analysis for the alternatives, below, this EA will only address those resources and impacts where the BLM has determined there are new circumstances or information, or where BLM believes it will be helpful to inform the public about actions that may occur on public lands. This approach comports with the BLM's NEPA Handbook H-1790-1 (at page 28).

For additional descriptions of the potential effects for the alternatives considered below, please refer to the RMP FEISs referenced in Section 1.3.

Based on existing development, BLM has estimated that up to 9 wells could be installed on these parcels (lease sale RFD for Alternative 2 - Proposed Action). This lease sale RFD is used to provide context for potential impacts. The percent of leases held by production is determined by dividing the 5-year average of the acreage of producing leases by the 5-year average of total leased acreage. Surface Hole Location (SHL) well spacing (SHL/acre) is determined by dividing the 5-year average of Federally producing wells by the 5-year average of the acreage of producing leases. The BLM oil and gas statistics for the data is located at the following website: <https://www.blm.gov/programs-energy-and-minerals-oil-and-gas-oil-and-gas-statistics>. To find the RFD for the proposed parcels listed in Alternative 2 utilizing the Emissions Calculation Tool, the BLM input the proposed number of acres (2,443.11) and the number of parcels in the proposed action. The tool multiplies the 5-year average

of producing leases (47.29%) by the 5-year average of Federally producing wells per lease (0.0074). The Emissions Tool predicts an RFD of up to 8.5 wells as reasonably foreseeable for the lease acreage proposed for Alternative 2. The RFD calculation is used to identify potential emissions, and BLM used the same RFD (9 wells) throughout the analysis.

Resources Carried Forward for Analysis

The BLM IDT identified resources that could be affected by the Proposed Action and alternatives and potential environmental impacts for each resource as the key issues to be analyzed in the EA.

Resources that are not present or are not affected by the Proposed Action or alternatives, as determined during scoping, do not warrant further analysis. These resources will not be discussed further in this EA.

3.1 Air Resources

3.1.1 Air Quality

The Wyoming Bureau of Land Management (WSO) has prepared an air monitoring report to present existing air quality conditions for use in BLM-WY NEPA analyses. The BLM authorizes activities that can affect air resources by releasing pollutants into the atmosphere. The report presents current Wyoming air quality conditions and monitoring trends and existing emissions data for inclusion in NEPA analysis and represents the existing Affected Environment for air resources in Wyoming. Additionally, the report is used to promote education, awareness, and transparency of air resources on public lands. The 2023 Air Resource Monitoring Report incorporated by reference as the foundation for this analysis.

Greenhouse Gas Emissions

Current ongoing global climate change is caused, in part, by the atmospheric buildup of GHGs, which may persist for decades or even centuries. The buildup of GHGs such as carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and fluorinated gases since the start of the industrial revolution has substantially increased atmospheric concentrations of these compounds compared to historical background levels. Climate change is a global process that is affected by the sum total of GHGs in the Earth's atmosphere. GHGs act to contain solar energy loss by trapping longer wave radiation emitted from the Earth's surface and act as a positive radiative forcing component. GHGs influence the global climate by increasing the amount of solar energy retained by land, water bodies, and the atmosphere. GHGs can have long atmospheric lifetimes, which allows them to become well mixed and uniformly distributed over the entirety of the Earth's surface no matter their point of origin. The buildup of these gases has contributed to the current changing state of the climate equilibrium towards warming. A discussion of past, current, and projected future climate change impacts is described in Chapters 4, 8, and 9 of the Annual GHG Report. These chapters describe currently observed climate impacts globally, nationally, and in each State, and present a range of projected impact scenarios depending on future GHG emission levels.

The impact of a given GHG on global warming depends both on its radiative forcing and how long it lasts in the atmosphere. Each GHG varies with respect to its concentration in the atmosphere and the amount of outgoing radiation absorbed by the gas relative to the amount of incoming radiation it allows to pass through (i.e., radiative forcing). Different GHGs also have different atmospheric lifetimes. Some, such as methane, react in the atmosphere relatively quickly (on the order of 12 years); others, such as carbon dioxide, typically last for hundreds of years or longer. Climate scientists have calculated a factor, known as the global warming potential (GWP), for each GHG that accounts for these effects. The GWP is used as a conversion factor to convert a mixture of different GHG emissions into carbon dioxide equivalents (CO₂e). The larger its GWP, the more the specific gas warms the Earth as compared to CO₂. The BLM uses the 100-year time horizon for GWPs in most report metrics, to be consistent with the scientific and regulatory communities that develop climate change assessments and policy. The 100-year GWP (GWP100) was adopted by the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol and is now used widely as the default metric by researchers and regulators.

The incremental contribution to global GHGs from a single proposed land management action cannot be accurately translated into its potential effect on global climate change or any localized effects in the area specific to the action. Currently, global climate models are unable to forecast local or regional effects on resources resulting from a specific subset of emissions. However, there are general projections regarding potential impacts on natural resources and plant and animal species that may be attributed to climate change resulting from the accumulation of GHG emissions over time. In this EA, the BLM uses GHG emissions as a proxy for impacts and provides context with other proxies such as GHG equivalents and the social cost of GHGs.

For the purposes of this EA, the projected emissions from the proposed action can be compared to modeled emissions that have been shown to have definitive or quantifiable impacts on the climate in order to provide context of their potential contribution to climate change. Table 3-1 shows the total estimated GHG emissions from fossil fuels at the global, national, and state scales over the last six years. Emissions are shown in megatonnes (Mt) per year of carbon dioxide equivalent (CO₂e). Chapter 3 of the Annual GHG Report contains additional information on GHGs and an explanation of CO₂e. State and national energy-related CO₂ emissions include emissions from fossil fuel use across all sectors (residential, commercial, industrial, transportation, and electricity generation) and are released at the location where the fossil fuels are consumed.

Table 3-1. Global and U.S. Fossil Fuel GHG Emissions 2015 - 2021 (Mt CO₂/yr)

Scale	2016	2017	2018	2019	2020	2021
Global	36,465.6	36,935.6	37,716.2	37,911.4	35,962.9	37,500
U.S.	4,909.9	4,852.5	4,989.8	4,855.9	4,344.9	4,639.1
Wyoming	60.30	61.6	62.6	57.8	54.5	53.2

Source: Annual GHG Report, Chap. 5, Table 5-1 (Global and U.S.) and Table 5-2 (State).

Mt (megatonne) = 1 million metric tons

NA = Not Available

Additional information on current state, national, and global GHG emissions as well as the methodology and parameters for estimating emissions from BLM fossil fuel authorizations and cumulative GHG emissions is included in the Annual GHG Report (see Chapters 5,6, and 7).

The National Emissions Inventory (NEI) is a comprehensive and detailed estimate of air emissions of criteria pollutants, criteria precursors, and hazardous air pollutants. The NEI is released every three years based primarily upon data provided by State, Local, and Tribal air agencies for sources in their jurisdictions and supplemented by data developed by the U.S. EPA. The NEI includes emissions estimates for point, nonpoint, and mobile sources (EPA 2023).

GHG emissions information is available in the most recent NEI (2020) and includes emissions data for mobile sources, prescribed fires, and wildfires while the FLIGHT tool includes emissions data for major industrial facilities. No reliable information for residential, commercial, agriculture, and fugitive emissions are available at county level scales. County level anthropogenic GHG emissions from the NEI are provided in Table 3-2.

Table 3-2. County level GHG Emissions (CO₂e) in Metric Tonnes (t) for the 2020 Reporting Year

County	CO ₂ (t)	CH ₄ (t)	N ₂ O (t)	County Total
Albany	2,572,183.62	8,743.74	6.95	2,580,934.30
Big Horn	141,997.06	66.45	2.22	142,065.73
Campbell	613,782.34	191.46	9.08	613,982.88
Carbon	2,687,870.33	9,541.49	5.73	2,697,417.55
Converse	539,494.94	170.02	8.39	539,673.35
Crook	197,391.86	25.03	2.25	197,419.14

County	CO ₂ (t)	CH ₄ (t)	N ₂ O (t)	County Total
Fremont	406,588.93	59.96	6.17	406,655.06
Goshen	226,729.34	29.19	4.38	226,762.91
Hot Springs	65,287.27	28.65	0.83	65,316.75
Johnson	305,414.07	220.43	1.81	305,636.30
Laramie	1,129,836.90	89.65	15.77	1,129,942.32
Lincoln	244,821.53	26.09	3.74	244,851.36
Natrona	717,868.87	130.20	10.87	718,009.93
Niobrara	120,768.15	24.19	1.79	120,794.13
Park	369,305.27	167.21	5.45	369,477.94
Platte	313,967.42	112.24	3.59	314,083.25
Sheridan	425,034.98	358.89	5.49	425,399.36
Sublette	157,926.70	131.35	1.64	158,059.69
Sweetwater	1,128,165.07	111.48	11.95	1,128,288.50
Teton	421,638.31	543.21	4.02	422,185.53
Uinta	413,146.74	39.04	4.55	413,190.33
Washakie	239,578.45	533.83	1.37	240,113.65
Weston	158,823.53	21.87	3.23	158,848.64
State Total	13,597,621.68	21,365.67	121.25	13,619,108.60

Future development of the lease parcels under consideration could lead to emissions of carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O); the three most common greenhouse gases associated with oil and gas development. These GHG emissions would be emitted from activities occurring on the leased parcels, and from the consumption of any fluid minerals produced. However, the BLM cannot reasonably determine at the lease offering stage whether, when, and in what manner a lease would be explored or developed. The uncertainty that exists at the time the BLM offers a lease for sale includes crucial factors that would affect actual GHG emissions and associated impacts, including but not limited to the future feasibility of developing the lease, well density, geological conditions, development type (vertical, directional, or horizontal), hydrocarbon characteristics, specific equipment used during construction, drilling, and production, abandonment operations, product transportation, and potential regulatory changes over the 10-year primary lease term. Actual development on a lease is likely to vary from what is analyzed in this EA and will be evaluated through a site-specific NEPA analysis when an operator submits an APD or plan of development to the BLM.

For the purposes of this analysis, the BLM has evaluated the potential climate change impacts of the proposed leasing action by estimating and analyzing the projected potential GHG emissions from oil and gas development on the parcels. Projected emissions estimates are based on previous actual oil and gas development analyses, and any available information from existing development within the State.

Further discussion of climate change science and predicted impacts, as well as the reasonably foreseeable and cumulative GHG emissions associated with BLM's oil and gas leasing actions and methodologies are included in the 2022 BLM Specialist Report on Annual Greenhouse Gas Emissions and Climate Trends (BLM, 2023). This report presents the estimated emissions of greenhouse gases attributable to development and consumption of fossil fuels produced on lands and mineral estate managed by the BLM. The Annual GHG Report is incorporated by reference as an integral part of this analysis and is available at <https://www.blm.gov/content/ghg/>.

3.1.1.1 Monetized Impacts from GHG Emissions

The “social cost of carbon”, “social cost of nitrous oxide” and “social cost of methane” – together, the “social cost of greenhouse gases” (SC-GHG) are estimates of the monetized damages associated with incremental increases in GHG emissions in a given year. These numbers were monetized; however, they do not constitute a complete cost-benefit analysis, nor do the SC-GHG numbers present a direct comparison with other impacts analyzed in this document. SC-GHG is provided only as a useful measure of the benefits of GHG emissions reductions to inform agency decision-making. BLM uses the interim estimates of the social cost of carbon dioxide, methane, and nitrous oxide developed by the Interagency Working Group (IWG) on the SC-GHG (IWG, 2021).

The IWG’s SC-GHG estimates are based on complex models describing how GHG emissions affect global temperatures, sea level rise, and other biophysical processes; how these changes affect society through, for example, agricultural, health, or other effects; and monetary estimates of the market and nonmarket values of these effects. One key parameter in the models is the discount rate, which is used to estimate the present value of the stream of future damages associated with emissions in a particular year. A higher discount rate assumes that future benefits or costs are more heavily discounted than benefits or costs occurring in the present (i.e., future benefits or costs are a less significant factor in present-day decisions). The current set of interim estimates of SC-GHG have been developed using three different annual discount rates: 2.5%, 3%, and 5% (IWG 2021). To address uncertainty in the estimates, the IWG recommends reporting four SC-GHG estimates in any analysis. Three of the SC-GHG estimates reflect the average costs from the multiple simulations at each of the three discount rates. The fourth value represents higher-than-expected economic impacts from climate change. Specifically, it represents the 95th percentile of impacts estimated, applying a 3% annual discount rate for future economic effects. This is a low probability, but high impact scenario, and represents an upper bound of impacts within the 3% discount rate model. The BLM estimates of SC-GHGs are in Section 4.

3.2 Water Resources

Surface water hydrology within the area is typically influenced by geology, soil characteristics, precipitation, and vegetation. Anthropogenic factors that currently affect surface include livestock grazing management, private, commercial, and industrial development, recreational use, drought, and vegetation control treatments. Based on best available data, the vast majority of the nominated parcels are within the following HUC8 watersheds: Lower Wind, Lighting, Little Wind, Badwater, and Antelope.

Groundwater hydrology within the area of the parcels is influenced by geology and recharge rates. Groundwater quality and quantity can be influenced by precipitation, water supply wells and various disposal activities. Groundwater quality across the applicable field offices varies with depth from potable waters with low total dissolved solids (TDS) to highly saline, non-potable sources. Most of the groundwater in Wyoming is used for industrial, domestic and livestock/irrigation purposes. The information contained in Appendix 5.3, Hydraulic Fracturing White Paper (see section entitled Operational Issues/Water Availability and Consumption Estimates) is incorporated by reference.

The Wyoming State Geological Survey identifies groundwater aquifers and publishes public data on Wyoming aquifer characteristics. Based on this data the parcels nominated are within the Powder River Groundwater Basin in the following aquifers: Fort Union, and the Wasatch. The rock type identified in these aquifers include alluvium, claystone, colluvium, dune sand, fine-grained mixed clastic, loess, mixed clastic/carbonate, mudstone, sandstone, shale, and siltstone. Usable water and geological formations vary throughout Wyoming making it difficult to provide specific data for each individual parcel analyzed within this EA. Usable water zones are those waters containing up to 10,000 mg/L of total dissolved solids (TDS) (43 CFR 3172.5). The EPA definition of underground sources of drinking water (40 CFR 144.3) is an aquifer or its portion which supplies any public water system or contains a sufficient quantity of ground water to supply a public water system, and currently supplies drinking water for human consumption, or contains fewer than 10,000mg/l TDS and is not an exempted aquifer. Appendix 5.4 discusses general characteristics of the usable water zones and aquifer characteristics for the oil and gas basins where parcels have been nominated.

In addition to the above surface hydrology and aquifer information, BLM also reviewed each parcel for Active Water Wells identified by the Wyoming State Geological Survey (<https://main.wsgs.wyo.gov/gis/gis-groundwater>)

as well as BLM GIS layers for Named Creeks and Major Lakes and Rivers. Active water well permits were reviewed within the parcel boundary and within 2 miles of the parcel boundary which is the average reach of a horizontal wellbore. Specific water resource information for each of the parcels is shown in Table 3-3.

Table 3-3. Water Wells, Spring Developments, Major Lakes and Rivers within each Proposed Parcel

Parcel Number 2025-03-	Active Water Well Permits	Deepest Active Water Well (feet)	Active Water Well Permits (within 2 miles)	Deepest Active Water Well within 2 miles (feet)	Spring Development Permits	Spring Development Permits within 2 miles (feet)	Named Creeks (miles)	Major Lakes (acres) and Rivers (miles)
1926	-	-	10	750	-	-	-	-
1927	-	-	6	25	-	1	-	-
2006	2	742	242	7,136	-	-	-	-
7319	-	-	8	500	-	-	-	-

All four parcels contain land with private surface overlying federal minerals (i.e., split-estate). The private surface lands have or have the potential to contain private residences and associated facilities such as domestic or stock water supply wells. Lands used as rangeland can also have stock water supply wells.

3.3 Greater Sage-Grouse

Conservation of the Greater Sage-Grouse (*Centrocercus urophasianus*) and their habitats is a critical land-management issue for the BLM, the public, and the BLM’s partner agencies across the West.

The Greater Sage-Grouse currently occupies approximately about one-half of their historic distribution. On October 2, 2015, the U.S. Fish and Wildlife Service (FWS) published its finding that listing of the Greater Sage-Grouse under the Endangered Species Act of 1973 was not warranted. The FWS’s finding was based, in part, on the conservation strategies developed in Wyoming and other states which led the FWS to conclude that “the primary threats to greater sage-grouse have been ameliorated by conservation efforts implemented by Federal, State, and private landowners.” (80 FR 59858, dated October 2, 2015). As the FWS also acknowledged (id. at page 59882):

The key component of the Wyoming Plan is the application of State’s regulatory measures associated with the Wyoming Plan on all lands in Wyoming... The Federal Plans in the State incorporate the Wyoming strategy,[12] thereby ensuring implementation of the strategy on Federal land surfaces and subsurface regardless of the need for a State permit (see further discussion below). The completion of the Federal plans also facilitates greater coordination between the State and Federal agencies in implementing and monitoring the Wyoming Plan. This addition to the Wyoming Plan further increases the value of this effort in conserving sage-grouse by covering all lands in the State with a single regulatory framework to reduce affects to sage-grouse in the most important habitats in the State. Therefore, the strategy conserves sage-grouse through an effective regulatory mechanism for conservation.

For BLM-administered public lands in Wyoming, the BLM incorporated the State’s Greater Sage-Grouse conservation strategy by revising and amending its RMPs. The State of Wyoming’s Core Area Protection strategy for Greater Sage-Grouse “is based on the principle that conservation of important habitat essential to the maintenance of Greater Sage-Grouse and activities important to the State’s economy are not mutually exclusive.” (State of Wyoming Governor’s Executive Order 2019-3, at Appendix A, page 5). The important habitat areas

referred to in Executive Order (EO) 2019-3 are the Core Population Areas (CPAs), Connectivity Areas and Winter Concentration Areas designed by the State of Wyoming’s Sage-Grouse Implementation Team (SGIT). These CPAs encompass approximately 83% of the Greater Sage-Grouse population within the State (see 80 FR 59882) as identified by peak male lek attendance, and were mapped by the SGIT to:

...assimilate[] the highest sage-grouse density areas identified [in published conservation studies] as they were identified as the most productive habitats for sage-grouse in Wyoming. In addition, the mapping of Core Areas considered current and potential energy development and encapsulated areas historically low in production [citation omitted]...

To assist in the implementation of the RMP management decisions, the BLM issued several Instruction Memorandums (IMs) to help provide guidance. One of these was Instruction Memorandum 2016-143 (IM-2016-143 - “Implementation of Greater Sage-grouse Resource Management Plan Revisions or Amendments -Oil & Gas Leasing and Development Sequential Prioritization”) which was issued on September 1, 2016. On December 27, 2017, IM 2016-143 was rescinded and replaced with IM No. 2018-026 (“Implementation of Greater Sage-grouse Resource Management Plan Revisions or Amendments -Oil & Gas Leasing and Development Prioritization Objective”). On March 15, 2019, the Wyoming Greater Sage-Grouse Approved Resource Management Plan Amendment and Record of Decision was signed. Through a District of Idaho court decision (*Western Watersheds Project, et al v. Schneider*, 1:16-cv-00083-BLW) BLM was enjoined from implementing the 2019 BLM Sage-Grouse Plan Amendments for Idaho, Wyoming, Colorado, Utah, Nevada/Northeastern California, and Oregon, until such time as the Court can adjudicate the claims on the merits. The 2015 Plans remain in effect during this time. On February 27, 2020, a separate court decision from the District of Idaho (*Western Watersheds Project, et al v. Bernhardt*, 1:18-cv-00187-REB) enjoined certain provisions of the IM-2018-034 and replaced them with provisions from the IM-2010-117. Finally, a third case from the District of Montana (*Montana Wildlife Federation v. Bernhardt*, 4:18-cv-00069-BMM) vacated IM-2018-026. Due to these decisions, BLM WSO developed a new strategy to prioritize leasing within sage-grouse habitats, which is incorporated here and in chapter 4 of this EA.

For ease of discussion, BLM Wyoming categorized all parcels by habitat type using the following method:

- 1) Identify which parcels are wholly or partially within PHMA and assign an evaluation label of ‘PHMA’ to those parcels (if a parcel contains both PHMA and GHMA, the evaluation label becomes PHMA),
- 2) Identify parcels which are wholly or partially within GHMA and assign an evaluation label of ‘GHMA’ to those parcels (if a parcel contains both GHMA and Non-habitat, the evaluation label becomes GHMA),
- 3) Identify all parcels completely outside of sage-grouse habitat and assign an evaluation label of ‘Non-habitat’ to those parcels. Table 3-4 describes each parcel, its designated habitat type(s) and provides the ‘Evaluation Label’ for prioritization purposes.

Table 3-4. Greater Sage-Grouse Parcels Evaluation Label

Parcel Number	Nominated Acres	Delete in Full	Delete in Part	Acres Available	Non-habitat (P1)	GHMA acres (P2)	PHMA acres (P3/P4/P5)	Evaluation Label
1926	1,720.01	0.00	0.00	1,720.00		X		GHMA
1927	80.00	0.00	0.00	80.00		X		GHMA
2006	320.00	0.00	0.00	320.00		X		GHMA
7319	323.10	0.00	0.00	323.10		X		GHMA

In the table above, the P1 though P5 are priority habitat criteria discussed in Appendix 5.5.

In addition, the BLM has identified in Table 3-5 those parcels that are located within 5.28 miles (8.5 kilometers) of an active or occupied Greater Sage-Grouse lek which is consistent with the Wyoming Core Area Strategy, which BLM incorporated into the 2015 ARMPA. For consistency, BLM also used this same 5.28-mile approach for parcels and active or occupied leks in GHMA and non-habitat. The following table indicates which parcels are located within 5.28 miles of an active or occupied Greater Sage-Grouse lek.

Table 3-5. Greater Sage-Grouse Lek Distance

2025-03 Parcel Num.	Habitat Evaluation Label	1 mile	2 miles	3 miles	4 miles	5.28 miles
1926	GHMA			X	X	X
1927	GHMA					
2006	GHMA					
7319	GHMA					

The Wyoming Game and Fish Department 2022-2023 Greater Sage-Grouse Job Completion Report (JCR) discusses each Sage-Grouse Local Working Group (LWG) Area. BLM used the maps for each LWG and identified which parcels were in the respective LWG areas (Table 3-6). The 2021-2022 JCR has a discussion regarding lek monitoring, population trend, productivity, harvest, habitat, and disease. The 2022-2023 Greater Sage-Grouse Job Completion Report can be accessed at: <https://wgfd.wyo.gov/Hunting/Job-Completion-Reports>.

Table 3-6. Parcel in Respective Greater Sage-Grouse Local Working Group Areas

2025-03 Parcel Num.	Sage-Grouse Local Working Group (LWG) Area
1926, 1927, 2006, 7319	Northeast

In general, the 2022-2023 sage-grouse JCR indicates that statewide populations in Wyoming declined, as estimated by average males per active lek, from 2016 to 2021. Sage-grouse populations statewide have increased from 2021 to 2023. Sage-grouse harvest data suggest that productivity, measured as the number of chicks per female in the fall harvest, has been below that needed for stable populations since 2016. The WGFD estimate that >1.4 chicks/hen in the fall harvest generally result in stable to increasing sage-grouse populations, and productivity estimates since 2016 have been ≤ 1.2 chicks/hen except for 2022 where the number of chicks per hen in the fall harvest was 1.4. The data provided in the job completion report for the Northeast LWG area (where the nominated parcels are situated) suggest similar trends as those found statewide. Average peak males per lek counted generally declined from 2016 through 2023, with slight increases in 2020 and then again in 2023 compared to the year prior. Productivity (i.e., chicks per hen in the fall harvest) data are not provided for the Northeast region due to sample size constraints. According to the JCR, “Short-term trends in statewide populations are believed to be largely weather related. In the late 1990s, 2004-05, and again in 2014-15, timely precipitation resulted in improved habitat conditions allowing greater numbers of sage-grouse to successfully reproduce. Drought conditions throughout this decade are believed to have caused lower grouse survival leading to population declines. The current lessening of drought conditions could be influencing a stabilization, to slight increase, in population trends over the last couple years. While these trends are valid at the statewide scale, trends can be more varied at the local level. Sub-populations more heavily influenced by anthropogenic impacts (residential development, intensive energy development, large-scale conversion of habitat from sagebrush to grassland or agriculture, interstate highways, etc.) have experienced declining populations or localized extirpation.”

3.4 Big Game

General information regarding wildlife species and impacts in the subject planning areas can be found at the following locations within the respective Field Office’s RMP (see section 1.4)

Big Game Herd Units

The distribution and abundance of big game in the planning area is primarily a function of habitat quality and quantity, the availability of water, climate/weather, and the ability to move, or migrate between seasonal habitats.

The WGFD manages big game populations in herd units (HU). Herd unit boundaries generally do not match BLM field office boundaries, making analysis and correlation of resource data and big game population data difficult. The WGFD revises its population objectives for each big game species based on new habitat information, population trends, recreation demand, and public input.

The health of big game populations are generally inferred from population objectives set by the WGFD. Based on monitoring data, big game populations range greatly across the State when comparing these estimates to the herd unit population objectives. According to the WGFD’s 2022 Job Completion Reports, pronghorn herd unit population estimates range between 32.37% above to 76.92% below objective, mule deer range from 9.38% below to 83.53% below objective and elk population estimates range from 171.3% above to 12.96% below herd unit objectives.

Mule Deer

Of the parcels evaluated, the vast majority are located in the following HU’s: Cheyenne River, and North Converse. See Table 3-7 below for a list of HUs and parcel descriptions.

The 2023 WGFD JCR for the Casper Region indicates that the Cheyenne River mule deer herd unit is 61.6% below the population objective of 27,000 individuals. The CJR also indicates that this herd had excellent productivity and survival in 2014 and 2015. However, since 2016 productivity and survival have generally declined, and Epizootic Hemorrhagic Disease (EHD) and Blue Tongue Virus (BTV) outbreaks have increased adult mortality, especially in 2021 and likely in 2022 as well. Consequently, total population has been negatively impacted in this HU, since 2019, but the herd unit has the potential to increase with more favorable environmental conditions..

The 2023 WGFD JCR for the Casper Region indicates the North Converse mule deer herd unit is 56.3% below the population objective of 9,000 individuals. This herd experienced a dramatic reduction through 2011 likely caused by years of drought culminating in a harsh winter. According to the JCR, the population showed a slight upward trend through 2018, but has remained below objective and has declined from 2019 to present. Fawn production/survival has generally been poor over the past 5 years contributing to population decline and stagnation. The JCR also indicates this herd unit has been subject to a very high level of energy development disturbance over the past decade. Impacts from this development on the long-term carrying capacity of mule deer habitats are unknown, but potentially significant.

Table 3-7. Mule Deer Herd Units

DISTRICT OFFICE	FIELD OFFICE	HERD UNIT (#)	WGFD 2023 Population Objective	WGFD Population Estimate, 2023	Status meeting Objective	# Parcels within	# Overlap
HPD	CFO	North Converse (755)	9,000	3,934	56.3% Below	1	
HPD	NFO, BFO, CFO	Cheyenne River (740)	27,000	10,369	61.6% Below	3	

Designated Migration Corridors

Many big game species use seasonal migrations to avoid predators and deep snow, and to take advantage of spatially and temporally variable food sources (Kauffman et al 2021, USGS 2024). Research into the movements of mule deer in large numbers and at seasonal transition times, has resulted in the formal identification of migratory pathways resulting in the delineation and designation of State-recognized corridors.

As discussed in the WGFD’s UNGULATE MIGRATION CORRIDOR STRATEGY (February 4, 2016):

Sawyer and Kauffman (2011) found that approximately 95% of the migratory period is spent foraging at stopover areas. Habitat quality is higher in stopover habitat than in the area between stopover sites. In this study, deer used the

same stopover areas between years during all migratory periods. Avoidance of disturbance on and around stopover areas was important to migrating ungulates while disturbance in the areas between stopover areas was tolerated.

Lendrum et al. (2012) and Sawyer et al. (2013) found that given an increase in disturbance, ungulates may modify the timing of migration, constrict the size of the area used for migration and move through areas of increased development faster. Changing the timing of migration or moving from one seasonal range to another faster (e.g., winter range to summer range) results in the loss of synchronization between plant green-up and ungulate movements thereby reducing energy intake (Sawyer and Kauffman 2011). Both Lendrum et al. (2012) and Sawyer et al. (2013) found correlations between disturbance levels and measurable changes in animal response as indicated by their movement rate and locations. Sawyer et al. (2013) found ungulates moved through disturbed areas faster, detoured around disturbance, and reduced their use of stopover areas, thus constricting their migration both temporally and spatially. Importantly, both studies recommended keeping the standard for allowable disturbance within migration corridors below the level of detected impact. (@ page 3: <https://wgfd.wyo.gov/media/13364/download?inline>).

This same document (at 4) also noted:

It is also important to understand that migratory behavior can be lost (Bolger et al. 2008, Harris et al. 2009) and loss of the ability to migrate has led to sudden and dramatic declines in animal populations (Bolger et al. 2008). Migration is a learned behavior that may be difficult to reestablish once lost or diminished (Sawyer et al. 2013).

Acting under this strategy, the State of Wyoming has developed new methods for mapping these migration corridors and stopover areas. As a result of these new methods, the first mule deer migration corridor (MDC) designated was the Red Desert to Hoback (RD2H) which occurred on December 5, 2016. The Red Desert to Hoback (now called Sublette) corridor is the longest mule deer migration route ever recorded in the lower 48 states. Further information regarding big game migration can be located at <https://wgfd.wyo.gov/wyoming-wildlife/movement-matters/big-game-migration>.

New research data has also been produced as a result of these efforts. This research has provided a finer level of understanding into where migrating mule deer spend the most time (stopovers) during migration, where there are existing barriers or bottlenecks that constrict movement along the corridor. Other research has suggested that the vegetation within the corridors may be extensively used as forage by the herd as they migrate between winter and summer habitats, twice a year.

Other new research suggests that migratory behavior must be learned {Jesmer et al 2018}. The loss of corridor function is known to cause a migratory population to forget their migratory behavior under the most extreme of circumstances, including knowledge of where the main route is in the landscape. Questions remain regarding why corridors are where they are.

The WGFD has several ongoing mule deer collaring studies evaluating areas of seasonal movement. The WGFD has collected mule deer movement data to some degree in each of these areas and are currently working with stakeholders and agency personnel to identify related research and proactive conservation actions that are geared toward conserving habitats in each of these herd areas. Three mule deer migration corridors have been formally designated within Wyoming (<https://governor.wyo.gov/state-government/executive-orders>).

None of the parcels are located within designated migration corridors, as designated in the Wyoming Governor's Executive Order (EO) 2020-1. In addition, the Wyoming Game and Fish Department (WGFD) did not raise migration corridors as an issue during their review. Therefore, big game migration corridors will not be discussed further within this EA.

3.5 Lands with Wilderness Characteristics (LWCs)

Wilderness characteristics are resource values that include naturalness, outstanding opportunities for solitude, or outstanding opportunities for primitive and unconfined recreation. Areas evaluated for wilderness characteristics

generally occur in undeveloped locations of sufficient size (typically greater than 5,000 contiguous acres) to be practical to manage for these characteristics.

The BLM Land Use Planning Handbook (H-1601-1) states that the BLM must consider the management of lands with wilderness characteristics during the land use planning process. The criteria used to identify these lands are essentially the same criteria used for determining wilderness characteristics for WSAs. However, the authority set forth in Section 603(a) of FLPMA to complete the three-part wilderness review process (inventory, study, and report to Congress) expired on October 21, 1993; therefore, FLPMA does not apply to new WSA proposals and consideration of new WSA proposals on BLM-administered public lands is no longer valid. The BLM is still required under Section 201 of FLPMA to "...maintain on a continuing basis an inventory of all public lands and their resource and other values...." This includes reviewing lands to determine if they possess wilderness characteristics (see Appendix 5.8).

None of the parcels were found to contain LWCs. If a parcel is not within a 5,000 acre LWC area, they are not reviewed further in accordance with BLM policy contained in Manual 6310. Those parcels which have been determined to have lands with wilderness characteristics are available for oil and gas development under their respective RMPs. A complete list of all parcels and the LWC review can be located in Appendix 7.3.

3.6 Socioeconomics and Environmental Justice

3.6.1 Socioeconomics

Please refer to the applicable RMP FEISs for additional discussion on resource socioeconomics across the total project area.

The counties within which the proposed parcels are located collectively make up the socioeconomic analysis area in which potential socioeconomic impacts of the proposed lease sale are considered. The local customs, culture, and history of communities within Wyoming are entwined with the lands and mineral estates administered by the BLM. People derive a wide range of values from their access, use, development, and enjoyment of natural landscapes administered by each field office. These values contribute to the unique sense of place indicative to rural Wyoming, as well as to the social and economic well-being of households and communities across the analysis area. Just as BLM management actions can affect future access, use, development, and enjoyment of these natural landscapes, field office land use and leasing decisions can affect the social, cultural, and economic well-being of surrounding towns, cities, and rural areas. Wyoming has a long history in mineral development and accounted for more than 2% of U.S. total crude oil output and more than 2% of U.S. marketed gas production in 2021 (EIA 2022a; EIA 2022b).

Federal mineral royalties, severance taxes, sales and use taxes, and ad valorem taxes associated with mineral development historically comprise a significant amount of state and local revenues (WY LSO 2023). Specifically, these revenues from both federal and non-federal mineral production contribute significantly to respective General Funds for State and local government operations, public K-12 education coffers, and community colleges. Wyoming is in an additionally unique position where its tax and federal mineral royalty (FMR) revenues are supplemented with investment income derived from "legacy" benefits associated with historically garnered severance taxes, as well. Such revenue associated with Permanent Wyoming Mineral Trust Fund investment income and FMRs assist in reducing the tax burden on current Wyoming residents to support the range of government and public services residents currently receive (WY LSO 2023). While the estimated number of oil and natural gas producers across WY totaled about 584 in 2022, this amount is about 20% less than the total population of producers statewide in 2017. Converse County led the state in total amount of crude oil and lease condensate value, subject to severance tax, or the reduced severance rate, and ad valorem tax produced in 2022. Sublette County led the state in total natural gas value of both processed and unprocessed gas for calendar year 2022 (WY DOR 2023).

Table 3-8. Production Year 2022 Wyoming Fluid Minerals 1 (Federal and Non-Federal) -- A Summary

Commodity	Taxable Valuation (Total State Assessed Valuation)	Est. Ad Valorem (Property) Taxes	Est. Mineral Severance Taxes	# of Producers (Federal and Non-Federal)
Oil	\$7,667,800,744	\$485,844,982	\$460,068,045	389

Commodity	Taxable Valuation (Total State Assessed Valuation)	Est. Ad Valorem (Property) Taxes	Est. Mineral Severance Taxes	# of Producers (Federal and Non-Federal)
Natural Gas	\$6,256,097,281	\$393,975,948	\$375,365,837	195
% of State Total	80.5%	80.5%	79.8%	72.8%

Source: WY Department of Revenue 2023 Annual Report

¹ From both federal and non-federal production across Wyoming counties.

Table 3-9. Calendar Year 2022 WY Federal Oil and Gas Mineral Royalty Collections and Associated Disbursements back to Wyoming State and Local Governments

Commodity	FMRs Collected	Federal Mineral Revenue Disbursements back to Wyoming¹
Oil	\$ 618,617,084	\$302,322,149
Natural Gas	\$565,500,932	\$332,571,243
Total	\$ 1,184,118,016	\$634,893,392

Source: DOI Office of Natural Resources Revenue (ONRR 2023)

¹ Disbursement amounts also reflect revenues from bonuses and rents, however, estimated disbursements fluctuate primarily according to royalty revenues as royalties represent the largest source of funds disbursed back to states (Congressional Research Service 2020). The Wyoming oil and gas sector relies on both ongoing operational activities (development of existing leases) and new development opportunities (acquisition and development of new leases) to continue to provide local and regional jobs, income, and revenue on a sustained basis. Oil and gas lease sales contribute to employment for area residents, continued demand for oil and gas industry-related goods and services, and continued demand for industry support goods and services that generate additional indirect and induced economic contributions (such as sales and use tax revenue and employment from industries that supply goods and services to the oil and gas industry, like drilling equipment). More specifically, industry support goods and services contribute value in the form of employment and labor income associated with where fluid mineral development and operations personnel, and those who work in the oil and gas industry’s supply chain, spend their income, such as restaurants and retail stores. Thus, this demand continuity as promulgated by oil and gas lease sales also contributes to employment stability in sectors outside of, or within the economic ripple effect, of the Wyoming oil and gas industry.

The socioeconomic analysis area is characteristically rural, with sparse and fragmented residential populations speckled across the least populated state in the U.S. While the oil and gas industries of WY are embedded in the functionalities and livelihoods of the state’s communities, WY residents also deeply value the aesthetic, recreational, and overall environmental and ecological health of these lands; such diverse interests must be delicately balanced and considered equitably when analyzing the impacts of any specific land use(s).

3.6.2 Environmental Justice

CEQ Phase 2 Final Rule Regulations, released on May 1, 2024, updated the definition of environmental justice to be the same as EO 14096. “Environmental justice (EJ) means the just treatment and meaningful involvement of all people, regardless of income, race, color, national origin, Tribal affiliation, or disability, in agency decision-making and other Federal activities that affect human health and the environment so that people are fully protected from disproportionate and adverse human health and environmental effects (including risks) and hazards, including those related to climate change, the cumulative impacts of environmental and other burdens, and the legacy of racism or other structural or systemic barriers; and have equitable access to a healthy, sustainable, and resilient environment in which to live, play, work, learn, grow, worship, and engage in cultural and subsistence practices.” Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low- Income Populations, states “each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations...” (Executive Order 12898). Executive Order 12898 also fully applies to indigenous populations, including the importance of determining any tribal presence in a given plan or project area. The purpose of EO 12898 is to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects on low-income populations, minority populations, or indigenous populations that may experience common conditions of environmental exposure or effects associated with a plan or project. BLM policy, as contained in BLM Land Use Planning Handbook H-1601-1 (BLM 2005), provides direction on how to fulfill agency responsibilities for Executive Order 12898.

The Council on Environmental Quality (CEQ) has developed guidance to assist federal agencies with their NEPA procedures so that EJ concerns are effectively identified and addressed. The guidance focuses on identifying communities of concern using census data. Low-income populations are defined as those living below twice the

federal poverty rate (see Federal Interagency Working Group on Environmental Justice and NEPA Committee 2016; BLM EJ Implementation IM2022-059), as identified by the U.S. Census Bureau and Bureau of Land Management. Minority populations include the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic (CEQ 1997). A minority population is identified as a community of concern if either 1) the minority population of the area of analysis exceeds 50% of the population of the area of analysis, or 2) the minority population percentage of the area of analysis is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis (CEQ 1997:25). A minority population also exists “if there is more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above-stated thresholds” (CEQ 1997:26).

For this EA, the EJ analysis area is defined as all US Census block groups surrounding the associated parcels proposed to be offered for sale in each Alternative. Block groups are the smallest geographic areas for which the U.S. Census Bureau provides sample data and typically contain between 600 and 3,000 people. The parcels offered for sale are located in the Casper Field Office within Converse County, all within the same block group. If a parcel were located on or adjacent more than one block group, all proximal and/or immediately adjacent block groups would also be included in the analysis. The nearest block groups for this analysis are more than half a mile away so only the block group containing the parcels was included in the analysis. Adjacent block groups were considered, however. Adjacent block groups would be included to represent geographies proximal to the management area, associated potential transportation and access routes, and to be inclusive of regional rural and indigenous landscapes.

The population in this analysis area is estimated to total 1,045 people (USCB 2022). The reference area is the State of Wyoming for all parcels; reference areas smaller than the state of Wyoming are not suitable for this analysis due to the rural composition and resultingly sparse demographic data available at a consistent county level. Baseline EJ screening results for block groups surrounding all parcels are displayed in Section 4.6 *Environmental Consequences - Socioeconomics and Environmental Justice*. Of the 14 parcels proposed for lease, 3 associated Census block groups meet BLM and CEQ criteria for environmental justice consideration (BLM IM2022-059).

The socioeconomic analysis area is characteristically rural, with sparse and fragmented residential populations speckled across the state. Block groups are often thousands, if not millions, of acres in surface area due to this rurality and the associated population density. Proposed parcel acreage takes up a small fraction of these vast block groups, so, while an entire block group might meet EJ screening criteria, one cannot assume EJ populations represented in the block group are proximal enough to the parcel to experience associated adverse and disproportionate impacts. However, environmental justice populations identified within the analysis area block groups do constitute those at risk for disproportionately adverse impacts from federal oil and gas management decisions, including but not limited to disproportionately adverse socioeconomic and health-related impacts discussed in Section 4.6 *Environmental Consequences*, depending on a given rural population’s density and proximity to a proposed parcel. Such impacts discussed in Section 4.6 do not supersede existing applicable socioeconomic- and public health-related conditions characterized in Sections 3.1, 3.2, 3.6.1, and 3.6.3; rather, such information should be considered simultaneously when characterizing the potential for disproportionate adversity faced by identified environmental justice populations.

3.6.3 Public Health and Safety

Within the 62.5-million-acre management area of BLM WY there are 205,327 existing active well bores of all well types across all land jurisdictions. Such a level of development has previously been linked to the following public health and safety-related risks: occasional fire starts; spills of hazardous materials, hydrocarbons, produced water, or hydraulic fracturing fluid and corresponding potential contamination of air, soil, or water; exposure to naturally occurring radioactive material (NORM) in drill cuttings or produced water (refer to Section 5.3); traffic congestion and collisions from commercial vehicles and heavy use; infrequent industrial accidents; presence of hydrogen sulfide (H₂S); or increased levels of fugitive dust particulate matter equal to or less than 10 microns in diameter [PM₁₀] and particulate matter equal to or less than 2.5 microns in diameter [PM_{2.5}], other criteria pollutants, VOCs, and hazardous air pollutants (HAPs). Refer to the air quality analysis in Section 3.1.1 for projected levels of criteria pollutants, HAPs, GHG emissions, and VOC and NO_x emissions that contribute to ozone (O₃) formation, as well as NAAQS.

Future potential development of the nominated lease parcels would result in emissions of air pollutants that can lead to human health effects depending on the level and duration of exposure. The distance that air pollutants can travel depends on a multitude of environmental factors which vary geographically (e.g., climate, topography, land use) and temporally (e.g., time of day, meteorological conditions), making it inexact to predict the spatial extent of potential human health effects associated with future potential development of the lease parcels. In addition, there is no single distance from oil and gas wells that has been accepted across the scientific community as conveying health effects to human populations. However, several studies have found that residents living at varying distances within less than 1.25 miles of active oil and gas wells are at greater risk for experiencing health effects from air pollution than those living beyond 2000 m (Adgate et al. 2014; Czolowski et al. 2017; Haley et al. 2016; Kroepsch et al. 2019). If such residents were to also belong to a population meeting environmental justice criteria, the risk of experiencing health effects from air pollution is further magnified at a disproportionate rate.

HAPs are known or suspected to cause cancer or other serious health effects, such as compromises to immune and reproductive systems, birth defects, developmental disorders, or adverse environmental effects resulting from either chronic (long-term) and/or acute (short-term) exposure, and/or adverse environmental effects. Breathing ozone can trigger a variety of health problems, including coughing and sore or scratchy throat; difficulty breathing deeply and vigorously and pain when taking deep breaths; inflammation and damage to the airways; increased susceptibility to lung infections; aggravation of lung diseases such as asthma, emphysema, and chronic bronchitis; and an increase in the frequency of asthma attacks. Some of these effects have been found even in healthy people, but effects are more serious in people with lung diseases such as asthma. Breathing air with a high concentration of carbon monoxide (CO) reduces the amount of oxygen that can be transported in the blood stream to critical organs like the heart and brain. At very high levels, which are possible indoors or in other enclosed environments, CO can cause dizziness, confusion, unconsciousness, and death. Very high levels of CO are not likely to occur outdoors. However, when CO levels are elevated outdoors, they can be of particular concern for people with some types of heart disease. Particulate matter, also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. PM is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. PM is measured and regulated according to particle size. Smaller particles are associated with more negative health effects, including respiratory and cardiovascular problems, because they can become more deeply embedded in the lungs and may even get into the bloodstream.

The following links provide additional information on air pollution health effects:

Criteria Pollutants:

- Ozone (<https://www.epa.gov/ground-level-ozone-pollution>) (EPA 2022a)
- Particulates (<https://www.epa.gov/pm-pollution/particulate-matter-pm-basics>) (EPA 2022b)
- Nitrogen dioxide (<https://www.epa.gov/no2-pollution/basic-information-about-no2>) (EPA 2022c)
- Carbon monoxide (<https://www.epa.gov/co-pollution/basic-information-about-carbon-monoxide-co-outdoor-air-pollution#Effects>) (EPA 2022d)
- Lead (<https://www.epa.gov/lead-air-pollution/basic-information-about-lead-air-pollution#health>) (EPA 2022e)
- Sulfur dioxide (<https://www.epa.gov/so2-pollution/sulfur-dioxide-basics#effects>) (EPA 2022f)
- Hazardous air pollutants (<https://www.epa.gov/haps/health-effects-notebook-hazardous-air-pollutants>) (EPA 2021a)

4 Environmental Consequences

This chapter describes the impacts that may occur upon the implementation of the considered alternatives. This chapter is organized by resource topics, with the impacts of all alternatives combined under each resource and analyzed in terms of direct, indirect, and cumulative effects (40 CFR 1508.1(g)). Any proposed protective requirements determined to be appropriate through analysis in this document would be carried forward as stipulations to an approved authorization.

For the analyses below, and based upon past BLM monitoring activities, BLM assumed the average surface disturbance for a single vertical well to be 5 acres. Multiple wells can be centralized on one large pad which reduces

the overall surface disturbance. The majority of wells on centralized pads are drilled horizontally and could reach up to two miles from the surface hole locations. For these centralized multi-well pads, BLM assumed an average pad size of 20 acres (based upon recent monitoring activities) with 8 horizontal wells on each multi-well location. The majority of new site-specific Applications for Permit to Drill (APDs) submitted in Wyoming fall into this category. If 8 wells are located on a 20 acre well pad, each well would require approximately 2.5 acres of surface disturbance. For both vertical and horizontal well bores, BLM is assuming 9 wells could be drilled and completed for Alternative 2 (Proposed Action) resulting in 22.5-45 acres of disturbance if the well is not installed on an existing well pad. Over the past five years, the majority (approximately 97%) of the wells drilled have been directional or horizontal from multi-well locations.

4.1 Air Resources

4.1.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, the parcel(s) would not be leased, and no new foreseeable oil and gas development would occur on the subject lease parcels. Although no new criteria pollutant or GHG emissions from the development of these lease parcels would occur under the No Action Alternative, recent projections indicate that U.S. production levels are expected to remain static or even increase in the short-term.

Recent short-term energy outlook reports (STEO) published by the EIA (<https://www.eia.gov/outlooks/steo/>) (EIA, 2023) predict that the world's oil and gas supply and consumption will increase over the next 18-24 months. The STEO projections are useful for providing context for the cumulative discussion as the global forecast models used for the STEO are not dependent on whether the BLM issues onshore leases but are based on foreseeable short-term global supply and demand and include oil and gas development /operations on existing U.S. onshore leases. Recent STEOs includes the following projections for the next two years:

- U.S. liquid fuels consumption is projected to increase to 20.64 million barrels per day (b/d) in 2025 up from 20.33 million b/d in 2024.
- U.S. crude oil production is expected to average 13.3 million b/d in 2024 and rise to 13.7 million b/d in 2025.
- U.S. natural gas consumption is expected to average 89.9 Bcf/d in 2024, decreasing slightly to 89.5 Bcf/d in 2025.
- U.S. LNG exports are expected to increase from 12 billion cubic feet/day (Bcf/d) in 2024 to 14Bcf/d in 2025.
- U.S. Coal production is expected to total 501 million short tons (MMst) in 2024 and 475 MMst in 2025 and remain at 16% of total U.S. electricity generation for 2024 and 2025 compared to 17% in 2023 driven by on-going retirement of coal-fired generating plants.
- Generation from renewable sources is forecast to increase from 950.03 billion kW/h in 2024 to 1062.18 billion kW/h in 2025.

Recent events, both domestically and internationally, have resulted in abrupt changes to the global oil and gas supply. EIA studies and recent U.S. analyses (associated with weather impacts, etc.) regarding short-term domestic supply disruptions and shortages or sudden increases in demand demonstrate that reducing domestic supply (in the near-term under the current supply and demand scenario) will likely lead to the import of more oil and natural gas from other countries, including countries with lower environmental and emission control standards than the United States (EIA, 2023). Recent global supply disruptions have also led to multiple releases from the U.S. Strategic Petroleum Reserve in order to meet consumer demand and curb price surges.

The EIA 2023 Annual Energy Outlook (<https://www.eia.gov/outlooks/aeo/>) projects energy consumption increases through 2050 as population and economic growth outweighs efficiency gains. As a result, U.S. production of natural gas and petroleum and liquids will rise amid growing demand for exports and industrial uses. U.S. natural gas production increases by 15% from 2022 to 2050. However, renewable energy will be the fastest-growing U.S. energy source through 2050 as electricity generation shifts to using more renewable sources, domestic natural gas consumption for electricity generation is expected to decrease by 2050 relative to 2022. As a result, energy-related CO2 emissions are expected to fall 25% to 38% below 2005 level, depending on economic growth factors. Further

discussion of past, present and projected global and state GHG emissions can be found in Chapter 5 of the Annual Report.

Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad" (January 27, 2021), directs the executive branch to establish policies or rules that put the United States on a path to achieve carbon neutrality, economywide, by no later than 2050. This goal is consistent with IPCC's recommendation to reduce net annual global CO₂ emissions between 2020 and 2030 in order to reach carbon neutrality by mid-century. Federal agencies are still in the process of developing policies that align with a goal of carbon neutrality by 2050. In the short-term, the order has a stated goal of reducing economy-wide GHG emissions by 50 to 52% relative to 2005 emissions levels no later than 2030.

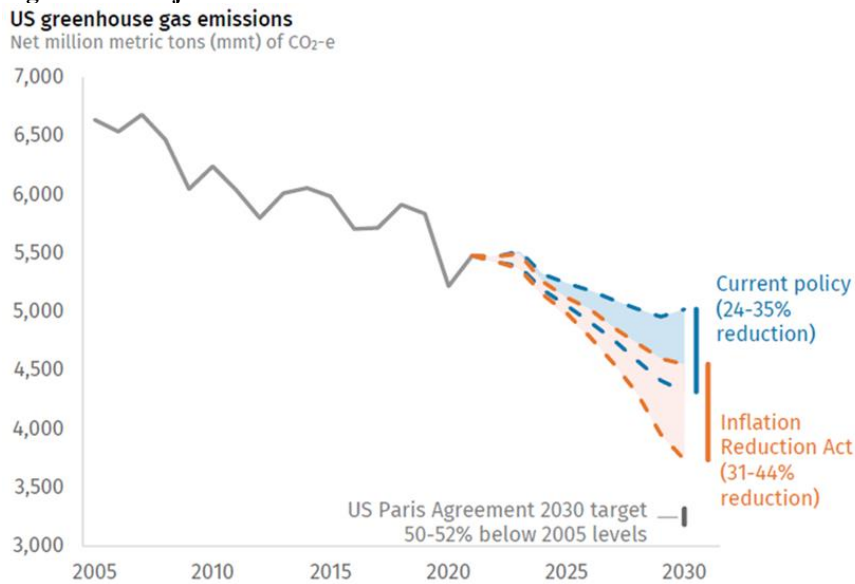
Carbon budgets are an estimate of the amount of additional GHGs that could be emitted into the atmosphere over time to reach carbon neutrality while still limiting global temperatures to no more than 1.5°C or 2°C above preindustrial levels. The IPCC Special Report on Global Warming of 1.5°C is the most widely accepted authority on the development of a carbon budget to meet the goals of the Paris Agreement. None of the global carbon budgets or pledges that countries have committed to stay within as part of the Paris Agreement are binding. Carbon budgets were originally envisioned as being a convenient tool to simplify communication of a complex issue and to assist policymakers considering options for reducing GHG emissions on a national and global scale. Carbon budgets have not yet been established on a national or subnational scale, primarily due to the lack of consensus on how to allocate the global budget to each nation, and as such the global budgets that limit warming to 1.5 °C or 2.0 °C are not useful for BLM decision making, particularly at the lease sale stage, as it is unclear what portion of the budget applies to emissions occurring in the United States.

The Council on Environmental Quality discourages Federal agencies from comparing emissions from an action to global or domestic levels as "such comparisons and fractions also are not an appropriate method for characterizing the extent of a proposed action's and its alternatives' contributions to climate change because this approach does not reveal anything beyond the nature of the climate change challenge itself (CEQ, 2023)." However, stakeholders and members of the public have requested that the BLM consider comparing the estimated Federal oil and gas emissions in the context of global carbon budgets. In the interest of public disclosure, Table 9-1 in the Annual GHG Report provides an estimate of the potential emissions associated with Federal fossil fuel authorizations in relation to IPCC carbon budgets. Total Federal fossil fuel authorizations including coal, natural gas and oil represents approximately 1.95 % of the remaining global carbon budget of 275 GtCO₂ needed to limit global warming to 1.5 C.

As detailed in the 2023 Annual GHG Report, which the BLM has incorporated by reference, the BLM also looked at other tools to inform its analysis, including the [Model for the Assessment of Greenhouse Gas Induced Climate Change \(MAGICC\)](#) (see Section 9.0 of the Annual GHG Report). BLM conducted MAGICC runs evaluating potential contributions to global climate change and related values for two climate change projection scenarios. These two scenarios were chosen because they most closely approximate or frame the desired outcomes of the Paris Climate Accord and would also reflect the greatest contribution as a percent of BLM's authorized cumulative emissions relative to the global emissions levels contained in the scenarios. IPCC's most optimistic scenario evaluates global CO₂ emissions cut to net zero around 2050. This is the only scenario that meets the Paris Agreement's goal of keeping global warming to around 1.5 degrees Celsius above pre-industrial temperatures. The second "middle of the road" scenario leaves global CO₂ emissions around current levels before starting to fall by 2050 but does not reach net-zero by 2100. In this scenario, temperatures rise 2.7 degrees C by the end of the century. The maximum BLM fossil fuel (oil, gas and coal) contribution to global temperature increases under these two scenarios is 0.015 C and 0.013 C, respectively.

While continued fossil fuel authorizations will occur over the next decade to support energy demand and remain in compliance with the leasing mandates in the Inflation Reduction Act (IRA) passed in 2022, the U.S. Energy Information Administration International Energy Outlook expects renewable energy consumption to double between 2020 and 2050 and nearly equal liquid fuels consumption by 2050. The U.S. has committed to the expansion of renewable energy through infrastructure investments in clean energy transmission and grid upgrades include in the Bipartisan Infrastructure Investment and Jobs Act as well as clean energy investments and incentives included in the Inflation Reduction Act.

Figure 4-1. Projected Short-Term Emissions Reductions Associated with the IRA



Source: Rhodium Group. The range reflects uncertainty around future fossil fuel prices, economic growth, and clean technology costs. It corresponds with high, central, and low emissions scenarios detailed in [Taking Stock 2022](#). Under the central scenario (not shown), the IRA accelerates emissions reductions to a 40% cut from 2005 levels.

4.1.2 Alternative 2 – Proposed Action

Any potential effects to air quality from the sale of lease parcels would occur at such time that any issued leases are developed and not at the leasing stage itself. The Proposed Action does not authorize or guarantee the number of wells analyzed herein. If leased, drilling of wells on a lease would not be permitted until the BLM approves an APD. Any APD received would be subject to site-specific NEPA review. However, development assumptions have been made in this EA to better inform the decision maker and the public of potential impacts to air quality if the leases are developed.

There are four general phases of post-lease development that would generate air pollutant emissions: 1) well development (well site construction, well drilling, and well completion), 2) well production operations (extraction, separation, gathering), 3) mid-stream (refining, processing, storage, and transport/distribution), and 3) end-use (combustion or other uses) of the fuels produced. While well development and production operation emissions (phases 1 and 2) occur on-lease and the BLM has authority over these activities, mid-stream and end-use emissions (phases 3 and 4) typically occur off-lease where the BLM has limited authority.

During well development, there could be emissions from earth-moving equipment, vehicle traffic, drilling, and completion activities. NO₂, SO₂, and CO would be emitted from vehicle tailpipes. Fugitive dust concentrations would increase with additional vehicle traffic on unpaved roads and from wind erosion in areas of soil disturbance. Drill rig and fracturing engine operations would result mainly in NO₂ and CO emissions, with lesser amounts of SO₂. These temporary emissions would be short-term during the drilling and completion phases, which is expected to last between 30 to 60 days.

During well production and operations there could be continuous emissions from separators, condensate storage tanks, flares or combustors, and tailpipe and fugitive dust emissions from operations traffic. During the operational phase of a well, NO₂, CO, VOC, and HAP emissions would result from the long-term use of storage tanks, pumps, separators, and other equipment. Additionally, dust (PM₁₀ and PM_{2.5}) would be produced by wind erosion on well pads and roads, and by vehicles servicing the wellsite infrastructure.

Emissions were estimated using the BLM Lease Sale Emissions Tool based on the total acreage of the lease parcels and the 5-year average of the number of lease acres held-by-production¹ divided by the total acres leased. Table 4-1 presents the estimated max year and average for the Proposed Action (9 wells). Actual development of individual lease parcels may result in higher or lower emissions for various reasons including differences with geologic formations, proximity to existing support infrastructure, differences in pace of development, different development methods and control technology used by a lessee, and other reasons. A lessee has 10 years to establish production on a lease, and if production is not attempted within the 10-year timeframe, the lease will be terminated with no development or emissions occurring.

Table 4-1. Estimated Max Year and Average Year Criteria and Hazardous Air Pollutant Emissions from Development of Alternative 2 (Proposed Action) Lease Parcels (tons/year)

Year	PM ₁₀	PM _{2.5}	VOC	NO _x	CO	SO ₂	HAPs
Max Emissions, Year 10	15.6	2.9	222.5	27.4	51.3	0.010	8.60
Average Emissions	10.5	1.9	175.2	17.4	39.2	0.008	6.78

Emissions of criteria air pollutants would also occur outside the impact analysis area from transport, processing, distribution, and end-use of produced oil and gas. Because there are potentially tens to hundreds of thousands of mid-stream and downstream emissions sources, the BLM is not able to quantify air quality and health impacts from these sources. Downstream combustion, whether in stationary facilities and motor vehicles/airplanes are regulated by the EPA, other Federal agencies, or delegated state agencies. This regulatory process is designed to avoid downstream impacts to regional and local air quality.

At the leasing stage it is not possible to accurately estimate potential air quality impacts by modeling due to the variation in emission control technologies as well as construction, drilling, and production technologies applicable to oil versus gas production utilized by various operators. Should development on the parcels be proposed, and prior to authorizing specific proposed projects on the subject leases, precise emission inventories would need to be developed and analyzed in a site-specific NEPA analysis. Near-field air quality modeling may also be required depending on the level of development proposed in order to address direct and cumulative impacts and demonstrate compliance with the NAAQS as well as impacts to AQRVs (i.e., deposition, visibility) if development is proposed near Class I areas (National Parks and Wilderness areas).

4.1.2.1 Greenhouse Gas (GHG) Emissions

While the potential sale of lease parcels does not directly result in development that will generate GHG emissions, emissions from potential future development of the leased parcels are reasonably foreseeable and can be estimated for the purposes of this lease sale. There are four general phases of post-lease development processes that would generate GHG emissions: 1) well development (well site construction, well drilling, and well completion), 2) well production operations (extraction, separation, gathering), 3) mid-stream (refining, processing, storage, and transport/distribution), and 4) end-use (combustion or other uses) of the fuels produced. While well development and production operation emissions occur on-lease and the BLM has authority over these activities, mid-stream and end-use emissions typically occur off-lease where the BLM has little to no authority.

Emissions inventories at the leasing stage are imprecise due to uncertainties including the type of mineral development (oil, gas, or both), scale, and duration of potential development, types of equipment (drill rig engine tier rating, horsepower, fuel type), and the mitigation measures that a future operator may propose in their development plan. In order to estimate reasonably foreseeable on-lease emissions at the leasing stage, the BLM uses

¹ [held-by-production](#) - A provision in an oil or natural gas property lease that allows the lessee to continue drilling activities on the property as long as it is economically producing a minimum amount of oil or gas. The held-by-production provision thereby extends the lessee's right to operate the property beyond the initial lease term.

estimated well numbers based on State data for past lease development combined with per-well drilling, development, and operating emissions data from representative wells in the area. The amount of oil or gas that may be produced if the offered parcels are developed is unknown. For purposes of estimating production and end-use emissions, potential wells are assumed to produce oil and gas in similar amounts as existing nearby wells. While the BLM has no authority to direct or regulate the end-use of the products, for this analysis, the BLM assumes all produced oil or gas will be combusted (such as for domestic heating or energy production). The BLM acknowledges that there may be additional sources of GHG emissions along the distribution, storage, and processing chains (commonly referred to as midstream operations) associated with production from the lease parcels. These sources may include emissions of methane (a more potent GHG than CO₂ in the short term) from pipeline and equipment leaks, storage, and maintenance activities. These sources of emissions are highly speculative at the leasing stage, therefore, the BLM has chosen to assume that mid-stream emissions associated with lease parcels for this analysis will be similar to the national level emissions identified by the Department of Energy’s National Energy Technology Laboratory (NETL, 2009) (NETL, 2019). Section 6 of the Annual GHG Report includes a more detailed discussion of the methodology for estimating midstream emissions.

The emission estimates calculated for this analysis were generated using the assumptions previously described above using the BLM Lease Sale Emissions Tool. Emissions are presented for each of the four phases of post-lease development processes previously.

- Well development emissions occur over a short period and may include emissions from heavy equipment and vehicle exhaust, drill rig engines, completion equipment, pipe venting, and well treatments such as hydraulic fracturing
- Well production operations, mid-stream, and end-use emissions occur over the entire production life of a well, which is assumed to be 30 years for this analysis based on the productive life of a typical oil/gas field
- Production emissions may result from storage tank breathing and flashing, truck loading, pump engines, heaters and dehydrators, pneumatic instruments or controls, flaring, fugitives, and vehicle exhaust
- Mid-stream emissions occur from the transport, refining, processing, storage, transmission, and distribution of produced oil and gas. Mid-stream emissions are estimated by multiplying the estimated ultimate recovery (EUR) of produced oil and gas with emissions factors from NETL life cycle analysis of U.S. oil and natural gas. Additional information on emission factors can be found in the Annual GHG report (Chapter 6, Table 6-8 and 6-10).
- For the purposes of this analysis, end-use emissions are calculated assuming all produced oil and gas is combusted for energy use. End-use emissions are estimated by multiplying the EUR of produced oil and gas with emissions factors for combustion established by the EPA (Tables C-1 and C-2 to Subpart C of 40 CFR § 98). Additional information on emission factors and EUR factors can be found in the Annual GHG Report (Chapter 6)

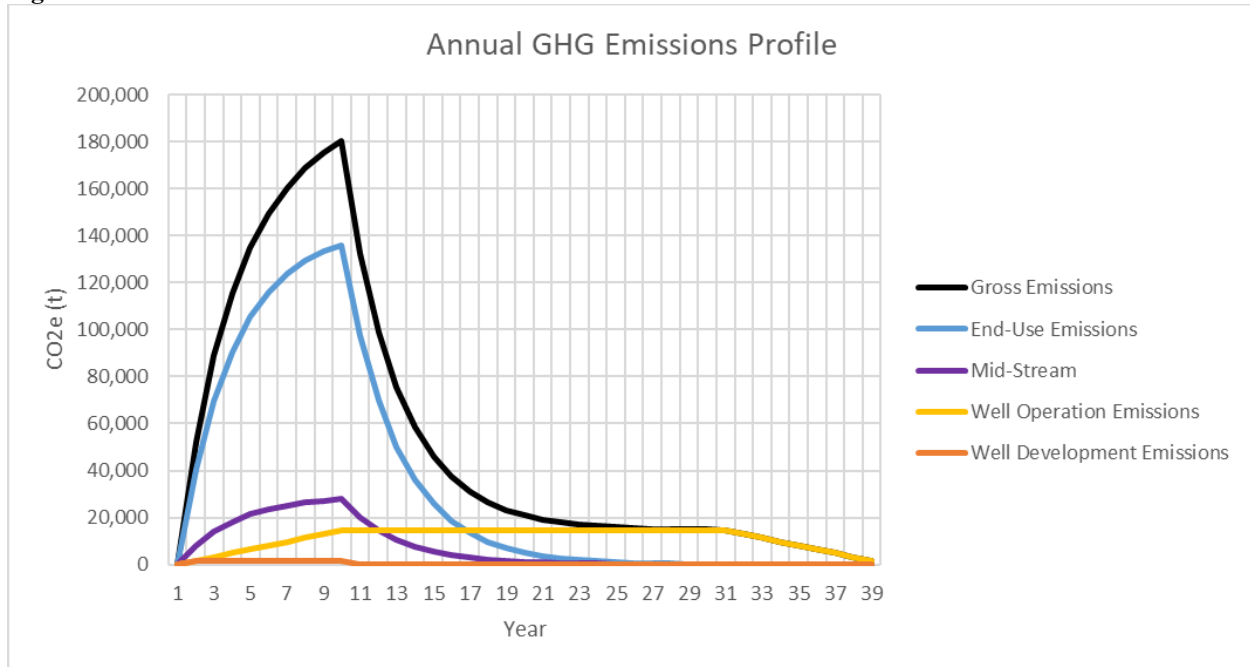
Table 4-2 lists the estimated direct (well development and production operations) and indirect (mid-stream and end-use) GHG emissions in metric tonnes (t) for the subject leases over the average 30-year production life of the lease. In summary, potential GHG emissions from the Proposed Action could result in GHG emissions of 2.36 Megatonnes CO₂e over the life of the lease.

Table 4-2. Alternative 2 (Proposed Action) Estimated Life of Lease Emissions (On-Site) from Well Development, Production Operations, and End Use (Metric tonnes)

Activity	CO ₂	CH ₄	N ₂ O	CO ₂ e (100-yr)	CO ₂ e (20-yr)
Well Development	15,918	9.07	0.125	16,223	16,701
Production Operations	300,741	4,551.89	0.690	436,576	676,460
Mid-Stream	203,506	2,063.37	3.028	265,821	374,561
End-Use	1,288,454	36.51	5.951	1,291,167	1,293,091
Total (Life of Lease)	1,808,619	6,660.84	9.795	2,009,786	2,360,813

GHG emissions vary annually over the production life of a well due to declining production rates over time. Figure 4-2 shows the estimated GHG emissions profile over the production life of a typical lease including well development, well production operations, mid-stream, end-use, and gross (total of well development, well production, mid-stream, and end-use) emissions.

Figure 4-2. Alternative 2 Estimated Annual GHG Emissions Profile Over the Life of a Lease



Source: BLM Lease Sale Emissions Tool

To put the estimated GHG emissions for this lease sale in a relatable context, potential emissions that could result from development of the lease parcels for this sale can be compared to other common activities that generate GHG emissions and to emissions at the state and national level. The EPA GHG equivalency calculator can be used (<https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>) to express the potential average year GHG emissions on a scale relatable to everyday life. For instance, the projected average annual GHG emissions from potential development of the subject lease are equivalent to 11,399 gasoline-fueled passenger vehicles driven for one year, or the emissions that could be avoided by operating 14 wind turbines as an alternative energy source or offset by the carbon sequestration of 62,963 acres of forest land. Table 4-3 compares the estimated annual lease sale emissions to existing Federal fossil fuel (oil, gas, and coal) emissions, State, and U.S. total GHG emissions.

Table 4-3. Alternative 2 (Proposed Action) Comparison of the Life of Lease Emissions to other Sources (Megatonnes)

Reference	Mt CO ₂ e ¹ (per year)
Lease Emissions (Maximum Year)	0.180
WY Onshore Federal (O&G) ²	100.21
WY Onshore Federal (Oil, Gas and Coal) ²	476.61

U.S. Onshore Federal (Oil & Gas) ²	611.55
U.S. All ³ Federal (Oil & Gas) ²	1,462.29
U.S. Federal Onshore (Oil, Gas and Coal) ³	1,046.33
U.S. Total (Oil, Gas, & Coal) ⁴	7,260.36

1 – Mt (megatonne) = 1 million metric tons. Estimates are based on 100-GWP values.

2 – Federal values come from the BLM Specialist Report on Annual Greenhouse Gas Emissions. Tables ES-1, ES-2 and Figure ES-1. U.S Federal-All includes offshore and onshore oil and gas production.

4.1.2.2 Monetized Impacts from GHG Emissions

The SC-GHGs associated with estimated emissions from future potential development of the lease parcels are reported in Table 4-4. These estimates represent the present value of future market and nonmarket costs associated with CO₂, CH₄, and N₂O emissions from potential well development and operations, and potential end-use. Estimates are calculated based on IWG estimates of social cost per metric ton of emissions for a given emissions year and BLM’s estimates of emissions in each year. They are rounded to the nearest \$1,000. The estimates assume development will start in 2025 and end-use emissions complete in 2063, based on experience with previous lease sales.

Table 4-4. Alternative 2 (Proposed Action) Social Cost of GHGs Associated with Development and Operations, all years (2024\$)

	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95 th Percentile Value, 3% discount rate
Development and Operations	\$6,995,7477	\$24,617,734	\$36,452,537	\$72,091,363
End-Use	\$26,371,171	\$94,181,554	\$140,417,816	\$284,271,697
Total	\$33,366,919	\$118,799,288	\$176,870,352	\$356,363,060

Source: BLM Lease Sale SC-GHGs Calculator

4.1.3 Cumulative Emissions

The analysis of GHGs contained in this supplemental EA includes estimated emissions from those leases as described above. An assessment of GHG emissions from other BLM fossil fuel authorizations including coal leasing and oil and gas leasing and development is included in the BLM Specialist Report on Annual GHG Emissions (Chapter 7). The Annual GHG Report includes estimates of reasonably foreseeable GHG emissions related to BLM lease sales anticipated during the fiscal year, as well as the best estimate of emissions from ongoing production, and development of parcels sold in previous lease sales. It is, therefore, an estimate of cumulative GHG emissions from the BLM fossil fuel leasing program based on actual production and statistical trends.

The methodologies used in Annual GHG Report provide estimates of foreseeable short-term and projected long-term GHG emissions from activities across the BLM’s oil and gas program. The foreseeable short-term methodology includes a trends analysis of (1) leased federal lands that are held-by-production (2) approved applications for permit to drill (APDs), and (3) leased lands from competitive lease sales projected to occur over the next annual reporting cycle (12 months). The data is used to provide a 30-year life of lease projection of potential emissions from all Federal oil and gas activities and potential lease actions over the next 12 months. The projected long-term methodology uses oil and gas production forecasts from the Energy Information Administration (EIA) to estimate GHG emissions out to 2050 that could occur from past, present, and future development of Federal fluid minerals. For both methodologies, the emissions are calculated using life-cycle-assessment data and emission factors. These analyses are the basis for projecting GHG emissions from lease parcels that are likely to go into production during the analysis period of the Annual GHG Report and represent both a hard look at GHG emissions from oil and gas

leasing and the best available estimate of reasonably foreseeable cumulative emissions related to any one lease sale or set of quarterly lease sales that could occur annually across the entire federal onshore mineral estate.

Table 4-8 presents the summation of the 30-year life-of-project emissions estimates for both the short and long-term as previously described for each state where federal mineral actions have been authorized. The differences between the short- and long-term emissions estimates can be thought of as an approximation of additional leasing that could occur on federal lands and does not take into consideration additional policies, technological advancements in production or end-use efficiency standards, or an accelerated economy-wide transition away from fossil fuel derived energy production.

A detailed explanation of the short-term and long-term emissions estimate methodologies are provided in sections 6.6 and 6.7 of the Annual GHG Report.

Table 4-5. GHG Emissions from Past, Present, and Reasonably Foreseeable Federal Onshore Lease Development (Megatonnes CO₂e)

State	Existing Wells (Report Year)	Existing Wells (Projected)	Approved APDs	New Leasing	Short-Term Foreseeable Totals	Long-Term Projected Totals
AL	0.51	7.56	0.00	0.18	7.74	15.28
AK	1.31	19.47	23.13	34.70	77.31	39.67
AZ	0.00	0.00	0.00	0.00	0.00	0.00
AR	0.55	8.72	0.24	0.24	9.19	16.63
CA	4.92	67.90	5.93	2.13	75.96	151.15
CO	46.16	399.35	30.80	23.95	454.10	1,395.90
ID	0.00	0.00	0.00	0.29	0.30	0.01
IL	0.01	0.11	0.00	0.02	0.13	0.26
IN	0.00	0.00	0.00	0.02	0.02	0.00
KS	0.26	3.81	0.00	0.11	3.92	7.80
KY	0.01	0.07	0.00	0.03	0.10	0.25
LA	3.84	48.54	44.95	13.11	106.60	115.95
MD	0.00	0.00	0.00	0.00	0.00	0.00
MI	0.07	1.36	0.00	0.58	1.94	2.11
MS	0.12	1.59	0.38	0.38	2.35	3.62
MT	2.52	25.68	0.42	12.63	38.73	77.12
NE	0.02	0.22	0.00	0.03	0.25	0.47
NV	0.13	1.01	0.01	0.19	1.22	4.07
NM	326.00	2,318.83	745.21	119.12	3,183.17	9,961.81
NY	0.00	0.01	0.00	0.00	0.01	0.01
ND	33.32	279.03	57.62	3.57	340.22	1,020.91
OH	0.40	3.83	0.00	4.64	8.47	12.20
OK	1.25	12.23	0.95	1.66	14.83	37.81
OR	0.00	0.00	0.00	0.12	0.12	0.00
PA	0.00	0.06	0.00	0.67	0.72	0.12
SD	0.11	1.77	0.11	0.11	1.98	3.23
TN	0.00	0.00	0.00	0.00	0.00	0.00
TX	3.31	36.52	19.00	1.97	57.49	99.95
UT	13.90	175.34	16.33	36.75	228.41	421.63
VA	0.01	0.14	0.00	0.03	0.16	0.27
WV	0.00	0.06	0.00	0.59	0.65	0.14
WY	103.34	920.76	178.16	317.98	1,416.91	3,134.55
Total Onshore Federal	542	4,334	1,123	576	6,033	16,523

While continued fossil fuel authorizations will occur over the next decade to support energy demand and remain in compliance with the leasing mandates in the Inflation Reduction Act (IRA) passed in 2022, the U.S. Energy Information Administration International Energy Outlook expects renewable energy consumption to double between 2020 and 2050 and nearly equal liquid fuels consumption by 2050. The U.S. has committed to the expansion of renewable energy through infrastructure investments in clean energy transmission and grid upgrades included in the Bipartisan Infrastructure Investment and Jobs Act as well as clean energy investments and incentives included in the Inflation Reduction Act.

Past and present actions that have affected and would likely continue to affect air quality in the analysis areas include surface disturbance resulting from ongoing oil and gas development and associated infrastructure, mining, ranching and livestock grazing, range improvements, recreation (including OHV use), authorization of ROWs for utilities and other uses, and road development. Past and present actions that have affected and would likely continue to affect air quality are too numerous to list but would include the development or conversion of power plants; the development of energy sources such as oil, gas, and coal, solar and wind; and the development of various industries that emit pollutants. These types of actions and activities can reduce air quality through emissions of criteria pollutants (including fugitive dust), VOCs, and HAPs, as well as contribute to deposition impacts and to a reduction in visibility.

4.1.3.1 Emission Control Measures Considered in the Analysis

The relationship between GHG emissions and climate impacts is complex, but a project's potential to contribute to climate change is reduced as its net emissions are reduced. When net emissions approach zero, the project has little or no contribution to climate change. Net-zero emissions can be achieved through a combination of controlling and offsetting emissions. Emission controls (e.g., vapor recovery devices, no-bleed pneumatics, leak detection and repair, etc.) can substantially limit the amount of GHGs emitted to the atmosphere, while offsets (e.g., sequestration, low carbon energy substitution, plugging abandoned or uneconomical wells, etc.) can remove GHGs from the atmosphere or reduce emissions in other areas. Chapter 10 of the Annual GHG Report provides a more detailed discussion of GHG mitigation strategies.

Several Federal agencies work in concert to implement climate change strategies and meet U.S. emissions reduction goals all while supporting U.S. oil and gas development and operations. The EPA is the Federal agency charged with regulation of air pollutants and establishing standards for protection of human health and the environment. The EPA has issued regulations that will reduce GHG emissions from any development related to the proposed leasing action. These regulations include the New Source Performance Standard for Crude Oil and Natural Gas Facilities (40 CFR 60, OOOOa), Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification or Reconstruction Commenced After November 15, 2021 (40 CFR 60, OOOOb) and Waste Emissions Charge for Petroleum and Natural Gas Systems (40 CFR 99). These regulations impose emission limits, equipment design standards, and monitoring requirements on oil and gas facilities and a waste emissions charge on methane emissions that exceed 25,000 metric tonnes of CO₂e for applicable petroleum and natural gas facilities currently required to report under the Greenhouse Gas Reporting Rule. A detailed discussion of existing regulations and Executive Orders that apply to BLM management of federal lands as well as current Federal and state regulations that apply to oil and gas development and production can be found in Chapter 2 of the Annual GHG Report.

The majority of GHG emissions resulting from federal fossil fuel authorizations occur outside of the BLM's authority and control. These emissions are referred to as indirect emissions and generally occur off-lease during the transport, distribution, refining, and end-use of the produced federal minerals. The BLM's regulatory authority is limited to those activities authorized under the terms of the lease, which primarily occur in the "upstream" portions of natural gas and petroleum systems (i.e., the well-development and well-production phases). This decision authority is applicable when development is proposed on public lands and the BLM assesses the specific location, design and plan of development. In carrying out its responsibilities under NEPA, the BLM has developed Best Management Practices (BMPs) designed to reduce emissions from field production and operations. BMPs may include limiting emissions from stationary combustion sources, mobile combustion sources, fugitive sources, and process emissions that may occur during development of the lease parcel. Analysis and approval of future development may include the application of BMPs within BLM's authority, included as Conditions of Approval, to

reduce or mitigate GHG emissions. Additional measures proposed at the project development stage may be incorporated as applicant-committed measures by the project proponent or added to necessary air quality permits. Additional information on mitigation strategies, including emissions controls and offset options, are provided in Chapter 10 of the Annual GHG Report.

The BLM can mitigate pollutants via lease stipulations and notices and further NEPA actions throughout the leasing and permitting processes. Stipulations and notices would be applied to leases when issued to notify the operator of what would be required (stipulation) and what could potentially be required (notice) at the APD stage. This informs the potential lessee, at the time of bidding on the parcel, of the range of requirements that could be expected when lease rights are exercised. Additional air quality control measures may be warranted and imposed at the APD stage (such as mitigation measures, BMPs, and an air emissions inventory). By applying stipulations and notices, the BLM can further minimize the impact on air quality from development activities. At the APD stage, further conditions of approval (COAs) can be applied based on the environmental analysis for the APD. These control measures would be informed by regional modeling studies or other analysis or changes in regulatory standards. Application of these notices would be sufficient to notify the lease holder of additional air quality control measures that are necessary to ensure protection and maintenance of the NAAQS. Also, any future development in nonattainment areas would be subject to the conformity process of the Clean Air Act which may require additional mitigation or offsets.

4.2 Water Resources

4.2.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, the Proposed Action or alternatives would not be authorized and BLM Wyoming would not offer any of the 5 parcels nominated. Ongoing oil and gas development, ranching, recreation, and other activities on BLM-administered lands would continue.

4.2.2 Alternative 2 – Proposed Action

Surface Water Quality and Quantity

The act of offering, selling, and issuing federal oil and gas leases does not produce impacts to watersheds. Indirect impacts from future development of a lease may result in long- and short-term alterations to the hydrologic regime depending upon the intensity and context of a specific proposal. Flows of perennial streams, ephemeral, intermittent rivers and streams could be directly affected in the short term by an increase in impervious surfaces resulting from the construction of the well pad and road. An increase in impervious surfaces provides for reduced infiltration which can then cause overland flow to move more quickly causing peak flow to potentially occur earlier, have a higher flow velocity and/or a larger volume than the channels are equipped for. Increased velocity and volume of peak flow can cause bank erosion, channel widening, downward incision, and disconnection from the floodplain. The potential hydrologic effect to low flow is reduced surface storage and groundwater recharge, which can then result in reduced base flow to perennial rivers and/or streams and potentially causing intermittent channels to become ephemeral. The direct impact would be that hydrologic processes may be altered where the perennial, ephemeral, and intermittent river and stream system responds by changing physical parameters, such as channel configuration. These changes may in turn impact water quality and ultimately the aquatic ecosystem through eutrophication, changes in water temperature, and/or a change in the food structure.

Minor long-term impacts to the watershed and hydrology could continue for the life of surface disturbance from water discharge from roads, road ditches, and well pads, but would decrease once all well pads and road surfacing material has been removed and reclamation of well pads, access roads, pipelines, and powerlines have taken place. Interim reclamation of the portion of the well pad not needed for production operation, re-vegetating the portion of the pad that is not needed for production operations, as well as re-vegetating road ditches and utility corridors would reduce this long-term impact. Short-term impacts to the watershed and hydrology from access roads that are not surfaced with impervious materials would occur and would likely decrease in time due to reclamation efforts.

None of the proposed parcels, based on best available data, contain riparian or wetlands habitat, or perennial water sources. The parcels do contain intermittent and ephemeral stream channels. Several of the parcels do contain water wells that are known to provide source water for stock operations or are classified as miscellaneous; miscellaneous wells typically supply groundwater for resource extraction purposes. These water wells, if they are improperly cased and cemented could be at risk from contamination from point or non-point releases should future operations result in fluid releases which migrate into the ground water table. These waters could potentially be impacted if there was a large and uncontrolled release of fluids during the drilling, completion or production process. Operators are required to address all waste management operations in their APD. These APDs would be reviewed to ensure that there is also adequate emergency response procedures in place.

Groundwater Quality and Quantity

Groundwater in general, could be affected by multiple factors, including industrial, domestic, or agricultural activities through withdrawal, injection (including chemical injection), or mixing of materials from different geologic layers or the surface. Withdrawal of groundwater could affect local groundwater flow patterns and create changes in the quality or quantity of the remaining groundwater. Based on an evaluation of statewide groundwater availability, and the total projected number of wells to be drilled/completed on BLM administered lands, adequate water supplies are available and would not result in significant impacts on a regional basis even during drought conditions. Exploration, development, and production of traditional oil and gas resources typically do not significantly deplete ground water on a regional basis but may have a limited, short-duration, near-well bore drawdown around the water supply well depending upon length and intensity of pumping activity. Oil and gas resources are often developed from geological reservoirs that do not contain significant amounts of freshwater with the exception of some CBM developed formations; however, the development and production of oil and gas can affect adjacent or nearby aquifers in the short term. Loss of a permitted source of groundwater supply due to drawdown would be considered a significant impact if it were to occur. The potential for long-term dewatering would be assessed at the development stage should a parcel be offered and a lease issued and subsequent development proposed. The drilling of horizontal wells, versus directional and vertical wells may initially appear to require a greater volume of water for drilling/completion purposes. However, a horizontal well develops a much larger area of the reservoir than a directional and/or vertical well and results in a lesser volume of fluids being required. Water depletions connected hydrologically potentially affecting the Colorado or Platte River drainages may affect T&E aquatic species or their designated critical habitats and would therefore require consultation with USFWS. Applicable point-source discharges would require permits under the National Pollution Discharge Elimination System (NPDES) and approval by the BLM prior to disposal of water produced from federal oil and gas leases; potential impacts would be mitigated at that time.

Several techniques may be used in exploration and development operations to increase or enhance the flow of oil and gas. They include hydraulic fracturing and acid introduction to dissolve the formation matrix and improve permeability, enhancing the flow of hydrocarbons .

Information contained in Appendix 5.3, Hydraulic Fracturing White Paper, Section III, Potential Impacts to Usable Water zones (Appendix pages 139- 142), is incorporated by reference. The information being incorporated by reference is generally summarized below. Impacts to the quality of groundwater, should they occur, would likely be limited to a near well bore location due to inferred groundwater flow conditions in the area of the parcels and based on studies completed in the Pinedale Anticline. Impacts to near well groundwater could occur from poor casing and/or cementing practices and the use of potentially hazardous materials within those formations containing freshwater and/or usable water zones.

Potential impacts result from the creation of artificial pathways between oil and gas reservoirs and adjacent aquifers. Modification of ground water flow paths may cause fresh groundwater to contact oil or gas. In addition, improper disposal of waste waters (brine, storm runoff), drilling/completion fluids, and other wastes can impact the quality of underlying ground water (U.S EPA 1987).

A high risk of fluid migration exists along the vertical pathways created by inadequately constructed wells and unplugged inactive wells. Brine or hydrocarbons can migrate to overlying or underlying aquifers in such wells. Since the 1930s, most States have required that multiple barriers be included in well construction and abandonment to prevent migration of injected water, formation fluids, and produced fluids. These well construction barriers

include (1) setting surface casing below all known aquifers and cementing the casing to the surface, and (2) extending the casing from the surface to the production or injection interval and cementing the interval. Barriers that can be used to prevent fluid migration in abandoned wells include cement or mechanical plugs. They should be installed (1) at points where the casing has been cut or perforated, (2) at the base of the lowermost aquifer, (3) across the surface casing shoe, and (4) at the surface. Individual states, including Wyoming, and the BLM have casing programs for oil and gas wells to limit cross contamination of aquifers. Any proposed drilling/completion activities would have to comply with 43 CFR § 3172, 43 CFR § 3160 regulations, and not result in a violation of a Federal and/or State law. If these conditions were not met, the proposal would be denied.

Information was previously submitted by the public raising concerns with wells in the Powder River Basin that have sections of the well bore that are cased but not cemented (“Tisherman Study”). As background, the Tisherman study states: “The sale of these parcels for further oil and gas development could impact groundwater resources in Wyoming. The BLM Onshore Oil and Gas Order No. 2 states, ‘The proposed casing and cementing programs shall be conducted as approved to protect and/or isolate all usable water zones...Determination of casing setting depth shall be based on all relevant factors, including: presence/absence of hydrocarbons; fracture gradients; usable water zones...All indications of usable water shall be reported’ (U.S. Bureau of Land Management, 1988). Usable water, according to the BLM Onshore Order No. 2 is ‘generally those waters containing up to 10,000 ppm (mg/L) of total dissolved solids (TDS).’ It is assumed then that for wells constructed on these proposed parcels: 1) the depth of usable water needs to be known and 2) the constructed wells need to have cemented casing at all depths of usable water.”

The stated goal of this study is: 1) identify zones of usable water (TDS < 10,000 mg/L) around the proposed parcels and 2) determine if current federal wells are actively protecting usable water in the same areas.

The study utilized information from the USGS to identify principal aquifers within 3000’ of ground surface to identify “usable water” aquifers. This information was then compared with information from well completion reports to the top of cement and bottom of surface casing for active federal well construction logs to assess and determine if the federal wells in their study area are protecting usable water zones near proposed parcel areas in the WY June 2022 lease sale environmental assessment. For each well, the bottom of the surface casing and top of cement was extracted from the well completion report, and the uncemented interval was calculated by taking the difference of these two depths.

The study alleges that “[F]or any well, if a gap exists between the surface casing and top of cement in a usable water zone, the well is endangering groundwater resources. Moreover, if existing wells have been approved by BLM without protecting all usable water zones as required by Onshore Order No. 2, it appears likely that oil and gas wells also will be approved in the future on the proposed lease parcels without requiring them to be constructed to protect groundwater resources.”

The study looked specifically at 62 wells in the Powder River Basin. The report concludes that:

- Among these 62 identified wells, 36 have a gap between the bottom of surface casing and the top of cement (Figure 7). The length of these gaps’ ranges from 275 to 7,714 ft with an average gap length of 2,653 ft. The average depth of surface casing in well with gaps is 2,196 ft bls (minimum 444 ft and maximum 3,550 ft). The average depth of top of cement in well with gaps is 4,850 ft bls (minimum 2,060 ft and maximum 9,970 ft).
- These gaps cross usable water zones. Seventeen of the wells have an uncemented gap occurring at less than 3,000 feet below surface (Table 5). This gap is located within the Lower Tertiary principal aquifer, which primarily contains usable water (TDS <10,000 mg/L) (Figures 5 and 7). Therefore, these seventeen wells have a gap in cement and surface casing that is threatening usable water and thus may not be in compliance with Onshore Oil and Gas Order No. 2.
- Nineteen of the wells have an uncemented gap occurring more than 3,000 ft bls (Figure 7). These gaps cross the lower Tertiary and upper Cretaceous aquifers. The lower Tertiary aquifer system may be as thick

as 7,180 feet in the Powder River Basin so all but 4 of the wells with gaps could be threatening the usable water in that aquifer.

- Below the lower Tertiary aquifer system is the upper Cretaceous aquifer, which contains the Lance and Fox Hills formations. While this aquifer system is more than 3,000 ft bls, it also contains usable water. Previous studies found that mean TDS levels estimated from oil and gas wells and produced water records found that water from 3,000-7,000 ft bls in the Powder River basin are all below <10,000 mg/L (Table 5) (Taboga et al., 2018). In wells installed between 1,000-6,000 ft bls, 95% had TDS levels <10,000 mg/L, while 83% of wells installed 6,000-7,000 ft bls had TDS levels <10,000 mg/L (Taboga et al., 2018). Thus, the nineteen wells with uncemented gaps occurring more than 3,000 ft bls are likely also in usable water aquifers.

Relevant Federal regulations pertaining to protection of freshwater and usable water zones include:

- 43 CFR 3162.5-2(d) requires: The operator shall isolate freshwater-bearing and other usable water containing 5,000 ppm or less of dissolved solids and other mineral-bearing formations and protect them from contamination.
- Onshore Order #2 was codified at 43 CFR 3170 and all subparts. 43 CFR 3172.5 defines usable water as: generally those waters containing up to 10,000 parts per million (ppm) of total dissolved solids.
- 43 CFR 3172.7(a) requires that: The proposed casing and cementing programs shall be conducted as approved to protect and/or isolate all usable water zones, potentially productive zones, lost circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. Any isolating medium other than cement shall receive approval prior to use.
- 43 CFR 3172.7(b)(1) requires that all casing, except the conductor casing, shall be new or reconditioned and tested casing and (b)(8) requires that all casing strings are tested to a sufficient pressure after they are set and cemented.
- 43 CFR 3172.7(b)(3) requires all surface casing be cemented back to surface either during the primary cement job or by remedial cementing.
- 43 CFR 3172.7(b)(6) requires all surface casing to have centralizers on the bottom 3 joints of the casing (a minimum of 1 centralizer per joint, starting with the shoe joint).
- 43 CFR 3172.7(b)(7) requires top cement plugs to be used to reduce contamination of cement by displacement fluid. A bottom plug or other acceptable technique, such as a suitable preflush fluid, inner string cement method, etc., shall be utilized to help isolate the cement from contamination by the mud fluid being displaced ahead of the cement slurry.

While the regulations at 43 CFR 3172.7(a) require usable water zones to be protected and/or isolated, this provision works in concert with the requirement to isolate other identified resources or formation conditions. Together, casing and cementing are fundamental to ensuring the safe, efficient, and environmentally responsible extraction of subsurface resources, and they ensure the well's integrity throughout its lifespan. Casing and cement serve several important purposes:

1. **Structural Support:** Casing provides structural integrity to the well, preventing the wellbore from collapsing under pressure or from surrounding rock formations. Cement bonds the casing to the surrounding formations, enhancing the structural stability of the well and provides additional structural support.
2. **Anchoring:** It anchors and supports the casing strings and provides a secure attachment point for blowout prevention equipment (BOPE), which is crucial for managing and maintaining well control.
3. **Isolation:** Creates a seal that prevent fluid migration between different geological zones and prevents the mixing of fluids between these zones. This is crucial for protecting aquifers from contamination and for helping to manage pressure and control the flow of fluids within the well.

4. Protection: Protects the wellbore from external pressures and temperatures and provides for casing corrosion protection.
5. Well Integrity: It ensures the overall integrity of the well throughout its lifespan, contributing to safe and efficient extraction operations.

Although the Tisherman study claims that uncemented sections of a wellbore are not protective of usable water zones in violation of Onshore Order #2 (43 CFR 3172), uncemented sections approved at the APD stage are deemed unnecessary for preventing fluid flow and mixing between zones.. This determination is made during the geological and engineering review, which concludes that cement is not required to inhibit fluid movement between these zones and the deeper production zone containing hydrocarbons, saline water, or helium. Even if a certain interval contains usable water, there may be no active fluid flow in that section, or the usable water interval might not be widespread throughout the formation. In such cases, cementing for isolation purposes is generally unnecessary. See Flow-Zone-Isolation, API Standard 65- Part 2 (2010) at page 21. The surface casing depth is chosen to find a competent formation with a fracture gradient in excess of known pore pressures in deeper horizons. This allows the operator to increase mud weight to safely continue drilling to the next casing point. Once the secondary casing point is reached, another casing string will be run into the hole. Where casing and cementing plans include a proposal to leave a section cased but not cemented, the BLM considers the following during geologic review: formation fluids (including water), confining layers, minerals, pressures, and temperatures. In many cases, it is not necessary to cement the secondary casing back to the surface in order to provide the required level of isolation. See API recommended Practice 100-1: 5.4.2. As part of the geologic evaluation, formation properties such as porosity, permeability, water salinity, fracture gradient, and pore pressure are considered as part of the review process. The goal is to ensure that the drilling plan has appropriately placed the casing points in competent formations, and determine which zones are acceptable to allow to remain open behind the casing string. The uncemented casing string allows the operator to reenter the wellbore and reclaim large portions of pipe when the well is eventually plugged.

BLM further protects usable water zones by ensuring that compatible drilling fluids are used (i.e. not allowing the use of oil-based mud in zones that are identified as having freshwater or usable water zones).

Once a lease is issued and the lessee submits an APD, the proposed well-bore and site-specific casing, cementing and mud program will be reviewed, and the proposal's adequacy in protecting and/or isolating usable will be determined at that time, as part of the APD review process. The operator is given the opportunity to correct any deficiencies that are found prior to review of the APD; if the operator cannot correct the deficiency(s) in accordance with Onshore Order No 2 (codified at 43 CFR 3172), the APD will be denied.

In accordance with 43 CFR 3162 and Onshore Order #1 (codified at 43 CFR 3171), the APD drilling plan must include site specific information including geologic formations, casing weights and grades, casing depths, casing conditions, cement properties, cement volumes, expected pore pressures, planned mud weights and types, blowout prevention, and all testing that will be performed. The engineering and geologic review compares this data against existing well information to ensure usable water zones are isolated from potential hydrocarbons and saline waters. Isolated in this instance, does not necessarily mean the zone will be cemented behind pipe for the aforementioned reasons. Uncemented but cased zones are still isolated as long as there is sufficient cement above and below the zone in the annular space of the wellbore. Casing is also a valid means of isolating formations when the bottom of the casing is cemented.

While some target formations for production may contain "usable waters" (less than 10,000 TDS), production from that target formation is going to be authorized consistent with lease rights granted, assuming the APD is compliant with regulation. If an application is submitted that would produce from a formation that contains usable water and is an underground source of drinking water, additional development restrictions may be necessary including the use of non-toxic drilling and completion fluids (such as in the case of coal bed methane where the wells are drilled and completed with freshwater). Before BLM could grant an APD, review of the drilling plan would have to confirm that those specific resources would be protected.

As to the specific wells identified in the Tisherman Study, BLM is unaware that any impacts to usable water zones have been reported. The State of Wyoming Oil and Gas Conservation Commission requires pre and post water quality testing. Specifically, Chapter. 3: Operational Rules, Drilling Rules: Section 46. Groundwater Baseline Sampling, Analysis and Monitoring, Part (a) states, “All operators are required to submit a groundwater baseline sampling, analysis and monitoring plan with an Application for Permit to Drill or Deepen a Well (Form 1). The groundwater monitoring program will consist of initial baseline water sampling and testing followed by a series of subsequent sampling and testing after setting the production casing or liner. This Rule will not apply to an existing oil or gas well that is converted to an injection well for enhanced recovery or disposal purposes.” In general, the potential for negative impacts to groundwater caused from completion activities such as hydraulic fracturing, have not been confirmed but based on its history of use are not likely. A recent study completed on the Pinedale Anticline did not find a direct link to known detections of petroleum hydrocarbons to the hydraulic fracturing process. Groundwater contamination investigations have also been conducted at the Pavillion gas field and according to a November 7, 2016, fact sheet from the Wyoming Department of Environmental Quality, it is unlikely that the hydraulic fracturing activities have caused impacts to water supply wells (<https://deq.wyoming.gov/water-quality/groundwater/investigations/pavillion-area-investigation/#1814069153>). The results from the November 2016 study were affirmed in the December 23, 2019, Final Pavillion, Wyoming Gas Field Domestic Water Wells Report on Recommendations for Further Investigation (<https://deq.wyoming.gov/water-quality/groundwater/investigations/pavillion-area-investigation/>). The 2019 report considered findings in a publication by DiGuilio and Jackson which posited that hydraulic fracturing may have been the source of detected organic compounds. Adequate isolation of zones containing usable water from the production zone(s), is confirmed through the use of completion reports and well logs. Where adequate isolation is not confirmed, remedial measures will be required.

After a review of the Tisherman study, BLM reviewed the records and identified 29 wells that have uncemented gaps at depths less than 3,000 feet below the surface. Of these, 6 wells have both the Fox Hills and Lance formations exposed, and 2 wells have the Lance formation exposed. BLM records also revealed that 10 wells have uncemented gaps at depths greater than 3,000 feet below surface. Of these 10 wells, 2 have both the Fox Hills and Lance formation exposed. During the geological and engineering review of the submitted Application for Permit to Drill (APD) package, it was determined that additional cementing was unnecessary to prevent fluid flow above the producing reservoirs to protect usable water zones. Using the information above (e.g. pore pressures, fracture gradients, and potential drilling hazards, API standards, regulations, geologic and engineering review, etc.), BLM determined that usable water (<10000mg/L) was protected to avoid any contamination from the hydrocarbon producing zone and these reservoirs are adequately sealed with casing and cement.

For the parcels included in this lease sale, based on existing well production in the area, future wells are not expected to produce from zones that contain usable water zones and are being used as a source of drinking water or supporting agriculture. Without a discrete development proposal, a finer level of analysis cannot be completed.

Assuming 9 wells would be developed under the lease sale RFD, based on a maximum of 3 million gallons per well completion job, total water needs is estimated to be approximately 27 million gallons. According to the water availability information contained in the Hydraulic Fracturing white paper, adequate water supplies are available to support future development. The exact source of water and groundwater availability will be further reviewed at the time an APD is submitted. The BLM encourages the use of recycled water for completion operations when possible, rather than relying on freshwater sources for oil and gas extraction.

Monitoring and Mitigation

Underground waste disposal is regulated under the Underground Injection Control (UIC) program, which was authorized under the Safe Drinking Water Act. If a drilling/completion proposal is found to not be protective of usable water zones, as required by 43 CFR § 3162.5-2(d) and 3172, the proposal could be denied by the BLM. Requirements for groundwater monitoring have been instituted throughout Wyoming by the WOGCC. This monitoring will add a level of certainty regarding the impacts of oil and gas drilling/completion activities on groundwater in Wyoming.

The use of practices such as, but not limited to, closed-loop mud systems or lined reserve pits would reduce or eliminate seepage of waste fluids into the soil from eventually reaching groundwater. The casing and cementing

requirements imposed on proposed wells would reduce or eliminate the potential for groundwater contamination from drilling/completion/production fluids and other surface sources. Additionally, the use of closed-loop or semi-closed loop drilling systems may be required by the BLM (see BLM-Wyoming Instruction Memorandum WY-2012-007, “Management of Oil and Gas Exploration and Production Pits”).

Stormwater Pollution Prevention Plans (SWPPs) are required by the State of Wyoming before any surface disturbance associated with construction actions greater than one acre in size. Prior to authorization of surface disturbance on a lease, the BLM will require a Surface Use Plan of Operations be submitted to the BLM; the BLM authorized officer may require additional erosion control measures to reduce the volume of surface runoff and subsequent sediment transport. Upon abandonment of the wells and/or when access roads are no longer in service, the BLM will require surface reclamation of the disturbed areas as described in Standard Lease Term No. 6 and in accordance with the approved APD or Sundry Notice.

All parcels are subject to Standard Lease Notice No. 1 which requires at a minimum 500’ offset from perennial surface waters. Site-specific analysis could require a greater offset requirement if site-specific impact analysis finds that it is warranted. Several parcels also contain specific stipulations for water resources (see Appendix 5.1).

4.2.3 Cumulative Impacts

Surface disturbance from ongoing oil and gas development, residential development, farming, ranching, and recreational activities would continue to result in disturbances to water resources. With more oil and gas wells being developed in proximity to fresh water, there is a potential for groundwater and surface water decline, as well as an increased possibility for nonpoint source pollution associated with ground disturbance to adversely affect water quality in receiving waterbodies. Water used to develop any of the proposed parcels could have a cumulative depletion effect, especially if other oil and gas development and regional water uses exceed recharge rates in the basins, which could affect surface flows and groundwater elevations. These effects could be increased during periods of drought.

Aquifers can be affected directly and indirectly by increasing the number of wells in an area. Direct impacts are a result of direct use of the groundwater. Indirect effects could result from declines in surface water resources, which could lead to increased groundwater withdrawals and net cumulative depletions of groundwater.

With the application of BMPs and design features to reduce runoff, erosion, and potentially associated nonpoint source pollution to downstream waterbodies would minimize cumulative effects to water quality. Based on information contained in the Hydraulic Fracturing White Paper, adequate water supply to support well development exists. The act of leasing would have negligible impacts to water resources. Alternative 2 is not expected to have foreseeable impacts to water resources or contribute to trends in the area that may impact water resources.

4.3 Greater Sage-Grouse

4.3.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, the Proposed Action or alternatives would not be authorized, and BLM Wyoming would not offer any of the 4 parcels nominated. Ongoing oil and gas development, ranching, recreation, and other activities on BLM-administered lands would continue.

4.3.2 Alternative 2 – Proposed Action

Under Alternative 2, the field office staff reviewed the potential parcels and recommended which lands need to be removed from further consideration (e.g. lands unavailable for lease due to RMP decisions); which lands need to be deferred (potential conflicts that may have arisen); and which leasing stipulations to apply based on RMP decisions. The District Offices sent a compiled list back to the WSO. The WSO received input from the WGFD regarding habitats or populations that may be impacted by the lease and used that information to verify the appropriate stipulations were attached to each parcel. BLM Wyoming also reviewed/evaluated the parcels based on the criteria outlined in IM 2023-007. The State Director (SD) and the District Managers (DMs) coordinated and discussed the

results from all reviews and parcel recommendations. The SD concurred on which potential parcels, or portions of parcels, move forward for analysis and inclusion in Alternative 2.

Using the prioritization screening process (outlined in Appendix 5.5), the WY BLM Resource Policy and Management division (WY930) has identified that none of the parcels are within PHMA.

As stated in the beginning of Chapter 4, Environmental Consequences, BLM is assuming 1 well would be drilled in Alternative 2. Overall surface disturbance for this well could range between 2.5-5 acres depending on if the well is a vertical well (each with an average of 5 acres of disturbance per well pad) or directional/horizontal wells (each with an average of 2.5 acres of disturbance per well pad). At most, BLM estimates there would be approximately 5 acres of sage-grouse habitat loss from this well.

Responses of individual birds and populations, coupled with variability in land-use patterns and habitat conditions, contribute to variability in the response of sage-grouse to development (Manier et al. 2014). As in Section 3.3, Table 3-5 (which identifies which parcels are within a specific distance of a lek), BLM identified which parcels are within 2 miles and 3.1 miles of PHMA using the minimum buffer distance in published research (Manier et al. 2014) along with the 2-mile timing limitation stipulation for leks situated in GHMA described in the ARMPA and the Wyoming Governor’s Executive Order 2019-03. In addition, BLM identified parcels within 4 miles and 5.28 miles of PHMA (with 5.28, or 8.3 kilometers) similar to how the PHMA areas around leks were designated (**Error! Reference source not found.**).

BLM reviewed all 4 parcels following the procedure detailed in Appendix 5.5 and identified the following potential impacts to sage-grouse and the potential to negatively influence the effectiveness of the State and BLM’s sage-grouse management strategy.

Parcels WY-2025-03-1927, 2006, and 7319 are situated in GHMA the Wyoming Game and Fish Department (WGFD) has flagged as being an area of concern for GRSG (reference Appendix 5.5), however none of the parcels are located in areas identified as important for connectivity, none of the parcels are located where development of the parcels would indirectly impact high value seasonal habitats as defined in Appendix 5.5, none of the parcels are located within 4 miles of an occupied GRSG lek, and all of the parcels are located within 1 mile of high-density energy development, active coal mining, and/or a state highway. Parcel WY-2025-03-1926 is situated in GHMA the WGFD has flagged as being an area of concern for GRSG and the parcel is situated within 4 miles of 4 GRSG GHMA leks (2 occupied and 2 unoccupied), however the parcel is not located in a connectivity corridor, the parcel is not located where development of the parcel would indirectly impact high value seasonal habitats as defined in Appendix 5.5, and the parcel is surrounded on 3 sides by existing gas/oil infrastructure within 3.1 miles (reference Table 4-6).

Table 4-6. Assessment of Potential Impacts to Greater Sage-Grouse Populations of Developing Parcels Nominated in GHMA

WY-2025-03 Parcel ID	Status	Indirect Impact Potential ¹	Core area	Pop. Trigger ²	Habitat Trigger ²	Prox. to Rest. Area	Connect	Existing Develop	WY 930 Recommend
1962	GHMA	N	n/a	n/a	n/a	N	N	n/a	Lease
1927	GHMA	N	n/a	n/a	n/a	N	N	n/a	Lease
2006	GHMA	N	n/a	n/a	n/a	N	N	n/a	Lease
7319	GHMA	N	n/a	n/a	n/a	N	N	n/a	Lease

¹ Parcel situated within 3.1 miles of a high value seasonal habitat (as defined)

² 2021 adaptive management analysis considered (2022-24 data unavailable)

It is reasonable to assume that leks within 3.1 miles of a well could experience negative impacts (NTT 2011) and that impacts as measured by the number of males attending leks are most severe near the lek, remain discernible out to >4 miles. This information suggests that the development of 1 parcel that is within 3.1 miles of 2 leks could

negatively impact GRSG populations. Habitats in PHMA have been identified by the BLM and the State as being the most important for maintaining sage-grouse populations statewide. None of the parcels proposed for this sale are located within PHMA; therefore, no direct impacts would be observed to these important habitats. GHMA habitats are important to provide potential movement corridors among PHMA in the State and can provide seasonal habitats important outside of the breeding period (e.g., late brood-rearing habitats; winter concentration areas). Although none of the parcels are situated in identified connectivity corridors or in designated seasonal habitats outside of PHMA, male sage-grouse could be displaced away from the leks situated near potential development of 1 of the parcels to less suitable lek location to avoid noise, traffic, habitat fragmentation, and other human disturbance. Female grouse may be displaced from highly desirable seasonal (e.g., nesting and brood-rearing) habitats into less desirable habitats for the same reasons as male displacement.

Some of these impacts are reduced during the construction and drilling phases by implementing the appropriate timing, and/or surface use stipulations (see Appendices 5.1 and 5.2). However, these direct and indirect impacts could remain once a well is producing oil and/or gas. These impacts would remain until the well is plugged and the location is reclaimed. Based upon nesting habitat requirements, impacts could be observed 20-50 years after a well pad is reclaimed depending on site-specific factors (i.e., soil type, precipitation, etc.). Based on site specific analysis, BLM could expand the size of the Timing Limitation Stipulation beyond 2 miles. Further, if determined necessary through site-specific analysis, BLM may control production and maintenance operations if unanticipated impacts are foreseeable.

The majority of the new wells drilled within the past five years are horizontal or directional. Using this type of scenario (horizontal or directional) direct impacts from habitat loss would be minimized (20 acres of direct habitat loss for vertical wells compared to 10 acres for directional or horizontal wells). However, there could still be direct loss of individuals from the population due to vehicle collisions or from potential increased predation. Indirect impacts would be similar to those described above.

Table 4-7. Leases near PHMA

Parcel ID 2025-03-	Within PHMA	Within 2 miles	With 3.1 miles	Within 4 miles	Within 5.28 miles
1926	-	-	-	-	-
1927	-	-	-	-	-
2006	-	-	-	-	-
7319	-	-	-	-	-

Table 4-8. Parcel evaluation and recommendation

WY-2025-03-Parcel Num.	Law or Reg. (i.e. drainage (P3))	Unit (P3)	Existing EIS or MLP (P3)	Area of High Development Potential	Adjacent to Existing Lease (P3)	Area of Prioritized Restoration Project (P4)	Land Health Standards (P4)	No Criteria Met (P4)	Adaptive Mgmt. Metrics (P5)	Initial Recommendation to SD
1926	-	-	-	X	X	-	-	-	-	Lease -
1927	-	-	-	X	X	-	-	-	-	Lease -
2006	-	-	-	X	X	-	-	-	-	Lease -
7319	-	-	-	X	X	-	-	-	-	Lease -

4.3.3 Cumulative Impacts

Due to the uncertainties from a lease development standpoint, it is difficult to predict exactly what impacts may occur. However, impacts from development of the Reasonably Foreseeable Development Scenario contemplated in the ARMPAs, such as the anticipated noise, permanent and temporary facilities, and traffic, are discussed in the

individual field office RMP, the 2015 ARPMA, and above. Additionally, within 1 mile of the 4 parcels there are 49 pending APDs, 5 approved APDs, 562 producing or shut-in Federal, State, or private wells (per WY Oil and Gas Commission), 42 authorized Oil and Gas leases, 0 Oil and Gas leases that were sold but not issued, 0 renewable projects, 7 existing grazing allotments, and numerous existing ROWs. Potential future development of these leases could contribute 9 APDs to cumulative impacts.

To minimize impacts, all parcels offered in this sale include Standard Lease Notice 3 (see Appendix 5.1). Standard Lease Notice 3 indicates that an operator may be required to implement specific measures to reduce impacts of oil and gas operations on the Greater sage-grouse populations and habitat quality (see Appendix 5.2 for exact language). Such measures shall be developed during the Application for Permit to Drill (APD) on-site and environmental review process. In addition, individual lease stipulations if a lek is located within a certain distance (e.g. Timing Limitation Stipulations [TLS]) or if a lek is located within the parcel itself (e.g. CSU or NSO) are attached to specific parcels as appropriate.

There are approximately 15,854,692 acres of PHMA in the State of Wyoming, which is equivalent to the areas identified as Core Areas under the Governor's Executive Order. In addition, there are approximately 27,836,621 acres of GHMA within the State of Wyoming. The new leasing rights would be subject to timing limitation stipulations (TLS), and no surface occupancy (NSO) stipulations for sage-grouse leks and habitat (as appropriate) within Greater Sage-Grouse habitats. Using the maximum number of acres that could be disturbed, 5 acres under Alternative 2, and assuming all wells are drilled in one habitat type (i.e. GHMA) there could be an overall reduction in habitat of approximately 0.00001796% GHMA statewide from approval of Alternative 2. Historically, approximately half (50%) of all leases produce in payable quantities; therefore BLM expects the amount of projected disturbance is an overestimation. Impacts beyond those analyzed in the underlying RMP FEIS' and the ARMPA FEIS, are not expected due to the use of adaptive management, imposition of lease stipulations and other site specific mitigation, and the continual expiration of existing federal leases whether because they lack production in paying quantities or are never explored. Additional coordination with WGFD will occur for all projects proposed in Greater Sage-Grouse habitats as determined necessary, and in accordance with the BLM-WGFD interagency MOU.

4.4 Big Game

4.4.1 Alternative 1 – No Action Alternative

Under Alternative 1, none of the parcels would be offered and impacts would be similar to those described in each FO RMPs.

4.4.2 Alternative 2 – Proposed Action

Under the Alternative 2, the BLM would offer 4 parcels for lease, covering 2,443.11 acres. At the lease sale stage, it is unknown where, or if, development would occur in any given nominated lease leases; as specific types and locations of development are proposed, their specific effects would be analyzed and addressed in detail at the time of proposed lease development. However, in general, of the acquisition and development of new leases covering 2,443.11 acres, as discussed on page 32, the action could directly affect approximately 2.5-5 acres (0.10% - 0.20% of total parcel acres) of potential mule deer habitat from surface disturbance associated with on-lease well development. It is also noted that historically speaking, of the total BLM WY authorized oil and gas development, approximately 50% of leases actually produce in payable quantities, therefore, the analysis below is likely an overestimation of impacts.

According to BLM WY field office RMPs, a summary of impacts to critical winter range related to oil and gas disturbance can contribute to additional habitat fragmentation, human activity, noise and introduction of weeds, invasive, noxious, or invasive annuals; depending upon the proposal and status of existing development if/where present, and the level of activity. In addition, according to BLM WY field office RMPs, a summary of impacts to migration corridors related to oil and gas disturbance can contribute to avoidance or abandonment of high-quality habitat near oil and gas disturbance and isolation of migration corridors to the critical winter range or parturition areas.

As discussed in Section 4 (pg. 32), under the Alternative 2, the BLM is assuming 2.5-5 acres (0.10% - 0.20% of total parcel acres) of surface disturbance across 4 parcels located in 1 of the BLM Wyoming field offices may result in direct big game habitat loss. This acreage amount does not include associated roads, powerlines, and other access infrastructure as there is no way to determine additional habitat impacts until a site-specific proposal is received from the proponent.

General Big Game Habitat

Big game habitat can be affected by oil and gas development outside of CWR areas. Direct impacts to big game habitats include direct loss of surface acres, fragmentation of range, and may directly or indirectly impact ecological function (stream hydrology, water quantity/quality). Impacts related to habitat disturbance are introduced during the construction and drilling phases and could remain once a well is producing oil and/or gas. These impacts remain until the well is plugged and the location is reclaimed. Based upon habitat requirements, impacts could be observed 20-50 years after a well pad is reclaimed depending on site-specific factors and the success of reclamation (i.e. soil type, precipitation, etc.).

The 4 parcels are within 2 mule deer herd units across the state of Wyoming (see Table 3-7). These herd unit ranges encompass approximately 5,746,454 acres of land; therefore, the proposed disturbed acreage (2.5-5 acres) affects less than 0.00039-0.00078% of mule deer herd unit range. When analysis is expanded to take into account potential mule deer avoidance (1-mile buffer) from pads, the results in less than 0.0028-0.0029% of mule deer unit range. Therefore, potential effects to mule deer are minimal.

Impacts to big game habitat are minimized by implementing appropriate surface use stipulations (NSO; see Appendices 5.1 and 5.2). The TLS and NSO stipulations within Appendices 5.1 and 5.2 are derived from each FO RMP. The WGFD was a cooperating agency during the development of these RMPs and the stipulation timeframes are based on WGFD input and data. The stipulations reduce habitat effects by restricting or prohibiting activity in important areas by requiring reasonable measures to ensure big game crucial winter range functionality (WY_BFO_TLS_BGCWEC), requiring mitigation plans to ensure restoration of habitat from disturbance (WY_BFO_CSU_SE) and ensuring continued habitat connectivity (WY Std Special Lease Notice II – Big Game Migration), and by ensuring ecosystem function by preserving water quality and ecosystem function (WY_BFO_CSU_H20500F; WY_BFO_CSU_FQM). The WGFD did not recommend any additional stipulations or deferrals for big game habitat as the existing stipulations remain adequate under the current RMPs. Also, BLM would consult with the WGFD during development if any of these leases are sold and development is proposed.

In addition to big game specific stipulations, various non-big game stipulations in Appendices 5.1 and 5.2 also help mitigate affects to big game species. Stipulations for sage grouse, raptor, fish, etc. are expected to serve as an umbrella to big game, including mule deer, occupying the same habitats by reducing habitat direct and indirect impacts by further restricting presence and site disturbance during the respective species activity periods, requiring mitigation plans for restoration, and preserving habitat connectivity. As specific types and locations of development are proposed, their specific effects would be analyzed and addressed in detail at the time of proposed lease development and in consideration of conditions that exist at the time an APD is submitted. Through site-specific analysis, timing stipulations can also be applied to routine maintenance operations.

Crucial Winter Habitat

Mule deer can be particularly susceptible to disturbance during winter because disturbance can cause undue energy expenditure when their vulnerability is greatest and their ability to respond to stress is lowest (USGS 2023). Of the parcels evaluated in Alternative 2, none of the parcels falls within designated mule deer crucial winter range (CWR); no parcels contain designated pronghorn crucial winter range; and none of the parcels designated intersect elk crucial winter range or managed parturition habitat as shown in Table 4-9. None of the nominated parcels are within elk feed grounds.

Table 4-9. Alternative 2 (Proposed Action) Crucial Winter Range and Migration Corridors

Parcel Number (WY-2024-06-)	Acres	Pronghorn (PH) CWR Acres	Mule Deer (MD) CWR Acres	Elk CWR Acres	Migration Corridor	Migration (High Use Acres)	Migration (Stopover Acres)	Recommendation
1926	1,720.01	-	-	-	-	-	-	Lease
1927	80.00	-	-	-	-	-	-	Lease
2006	320.00	-	-	-	-	-	-	Lease
7219	323.10	-	-	-	-	-	-	Lease

Human presence can cause displacement and avoidance in and around CWRs with more intensive oil and gas related activities. This disturbance can cause zones of avoidance that may extend over a mile for mule deer (Sawyer et al. 2008). In mule deer, population declines can be linked to avoidance behavior associated with development in open sage brush habitats in western Wyoming (Sawyer et al.2017), this has been shown less so for pronghorn and elk. Due to this avoidance, animal numbers can increase in areas surrounding development which may raise the risk of density-dependent effects, such as range over-utilization or disease transmission, which can lower survival and reproduction (Sawyer et al. 2006). In addition, with greater access via increased road numbers and densities can also increase both the legal and illegal harvest of wildlife by humans (Wyoming Game and Fish Department 2017).

Ungulates (mule deer, elk, pronghorn) are generally prey species, often reliant on a combination of visual, olfactory, and auditory cues to detect predators. Noise can be characterized by the onset, consistency, and regularity of the noise source. Noise during oil and gas development within CWR can range from short duration, such as a seismic blast or passing truck, to chronic, such as a compressor station (USGS 2023). Noise can shrink an individual’s listening area and cause the individual to avoid an area within CWR that have higher noise and relocate to areas of lower noise. Noise has been shown to affect big game by increasing vigilance with moderate noise levels in the winter and decreased habitat use with increased noise levels in spring, summer, and fall (USGS 2023, Lynch et al. 2015). General population effects consist of avoidance of oil and gas well sites, roads in oil fields, and can have negative effects on abundance in open areas (USGS 2023, Sawyer et al. 2017).

Oil and gas development (within CWR) can also increase the spread of invasive non-native species (INNS), which contributes to loss of certain desirable wildlife habitats, increased soil erosion, reduced water quantity and quality, and reduced structural and species diversity. (Kemmerer RMP FEIS p 94-95). Introduction of weeds, invasive or noxious vegetation, or invasive annuals, can result in establishment of populations. These new species or populations can outcompete native vegetation, degrading the quality of big game habitat up to decreasing the carrying capacity of the land, which can then cause loss of genetic viability if sustained over long periods of time. To minimize the proliferation and establishment of INNS, design features and stipulations are in place, such as requiring each proposed well permit to include an integrated pest management plan, a reclamation plan, and stipulations for weed management and prevention (weed wash stations, weed free seed).

Offering leases in CWR is not expected to result in new impacts to CWR in relation to habitat, human presence, noise and INNS beyond those identified in the base RMPs and narrative cited above. None of the proposed parcels are located within CWR. However general habitat disturbance could lead to incremental and cumulative habitat fragmentation, activity, and increased noise levels across the landscape.

To mitigate these potential impacts to habitat, human presence, noise, and INNS there are multiple CSU, TLS, NSO stipulations in place across affected BLM field offices by prohibiting surface disturbing activities or surface occupancy during these crucial winter periods, design features and stipulations requiring each proposed well lease to include an integrated pest management plan, a reclamation plan, and stipulations for weed management and prevention (weed wash stations, weed free seed), and requiring a CWR mitigation plans be submitted to the BLM by the applicant as a component of the permit to ensure that these impacts are minimized to the greatest extent practical. In addition, other species’ NSO and TLS stipulations are also expected to help further reduce disturbance

on crucial winter range that overlap areas with other special species (i.e. raptors, sage grouse, sensitive species, etc). A complete list of stipulations are found within Appendices 5.1 and 5.2 are derived from each FO RMP.

Migration Corridors:

Development of leases located in big game habitats can result in negative impacts to migration corridors. Whether occurring in a movement corridor or in other seasonal habitats, oil and gas related disturbance can result in wildlife populations shifting their foraging or reproductive behaviors from utilizing high quality habitat to areas of lower quality, less desirable habitat. Mule deer are sensitive to impacts of oil and gas development, particularly during migration and that migratory use and function deteriorate in routes or regions where surface disturbance exceeds 3% (Sawyer et al 2020). Areas of intensive activity or construction may become barriers to animal movement, including inhibiting big game from reaching crucial winter ranges and habitats important for reproduction (Sawyer 2010). Abandonment of important habitat can lower reproduction and survival rates of the species and result in a decline in wildlife populations.” (ARMPA, 4-426) Over utilization can occur as a result, further limiting the productive nature of the land and sustaining the population at hand. The effects can be more pronounced when additional restrictions on access occurs either through fences or other man-made intrusions, other land uses are competing for the same range resources, or when conditions such as drought or other climatic occurrences, affect growth and/or vegetation regeneration rates, including fire (Rawlins RMP 4-455, 4-456).

Of the 4 parcels, none (0 acres) contain designated migration corridors, therefore no direct effect is expected, and disturbance associated with development of these leases will not cause an exceedance of the 3% threshold (Sawyer et. al. 2020).

4.4.3 Cumulative Impacts

The incremental intensity of development and resultant impacts will be considered in combination with the context of the proposed action at the time development is proposed. These include other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions (40 CFR 1508.7). Due to the uncertainties from a lease development standpoint, it is difficult to predict exactly what impacts may occur. However, impacts from development in the individual field office ARMPAs, such as the anticipated noise, permanent and temporary facilities, traffic, wildlife moving from high quality habitat to areas of lower quality, less desirable habitat. Abandonment of important habitat can lower reproduction and survival rates of the species and result in a decline in wildlife populations. Additional information on cumulative impacts to big game and big game habitats are provided in the ARMPA at pages 4-423 – 4-427, 4-562, 4-508. Within 1 mile of the 4 parcels there are 49 pending APDs, 5 approved APDs, 562 producing or shut-in Federal, State, or private wells (per WY Oil and Gas Commission), 42 authorized Oil and Gas leases, 0 Oil and Gas leases that were sold but not issued, 0 renewable projects, 7 existing grazing allotments, and numerous existing ROWs. Potential future development of these leases could contribute 9 APDs to cumulative impacts.

Oil and gas development causes surface disturbance through construction of well pads, roads, pipelines, and other facilities. Reclamation and mitigation efforts would reduce impacts on wildlife habitat and fisheries; however, construction and maintenance of roads and well pads and the presence of humans would result in long-term or permanent impacts. Overall impacts would likely be greater where mineral development is more intense, in areas where development overlaps with crucial and winter wildlife ranges, and on state and private lands because of the lack of protections afforded to natural resources in these areas. If development expands, the ability of big game and other wildlife species to disperse into alternate habitats could become limited. This may create isolated populations in areas where habitats remain intact. The degree of impact would depend on the timing of development activities and whether the amount of activity outpaces the successful reclamation and revegetation efforts in disturbed areas. Because of this pace of development (whether federal mineral, commercial, or private residence), more pressure would be put on habitats outside of the development (likely private lands) as wildlife is displaced from the disturbances.

It is well known that CWR is important to the viability of big game. Persistent disturbance in sensitive habitats can shift the areas of use and weaken the tendency of the animals to return to the disturbed area. If animals don't return to disturbed habitat, populations could be lower as herds and individuals to move into native and unpredictable habitats that may not support the increased use by local and newly arrived, displaced populations. Mineral

development activities would likely cause displacement of animals and selection of alternative habitats and would likely inhibit big game movement between winter ranges and birthing areas. The displacement of big game, and specifically mule deer, from high-use to low-use areas has the potential to influence survival and reproduction (Sawyer et al. 2006). It is likely that negative effects (both in the short-term and potentially in the long-term) from displacement of big game from these habitats would occur.

There are over 16.6 million acres of big game crucial winter range (CWR) in the State of Wyoming. Of this amount, approximately 6,335,000 acres is Mule Deer CWR, 5,973,000 acres is Antelope CWR, and 4,361,359 acres is Elk CWR. Under Alternative 2 68,084.04 leased acres would be affirmed. The amount of those total acres that fall within CWR is; 8,490.92 ac mule deer CWR, 8,509.39 ac Antelope CWR and 2,236.71 ac Elk CWR. These total lease coverage numbers account for approximately 0.13% of all mule deer CWR, 0.14% of all Antelope and 0.05% of all Elk CWR within the state of Wyoming.

Based on the assumptions described at the beginning of Chapter 4, the BLM is assuming that 9 wells will be developed. With the estimated assumption of five acres of disturbance per well for vertical wells (45 acres total), and 2.5 acres disturbance for horizontal wells (22.2 acres total), the potential disturbance may occur within CWR from these leases is 0.0092-0.0184% of the mule deer, 0.0098-0.0195% of the Antelope and 0.0134-0.0267% of the elk CWR statewide. Any development that occurs within CWR will be mitigated through RMP stipulations outlined in Appendices 5.1 and 5.2. Daily operations from developed wells that go into production will still pose the potential to disrupt big game populations from noise and human presence, and increase the potential for vehicle collisions.

Where parcels are not located within approved project area EIS boundaries, and even to a certain extent those that are, as more reservoir data is gathered through exploratory drilling, the likelihood for sustained economic production should increase, and a decrease in dry holes should occur consistent with other types of field development. There is one approved EIS area (Converse Country Oil & Gas Project EIS) within one mile of the parcels.

See ARMPA FEIS pg. 4-509— 4-579, the Buffalo RMP FEIS pg. 871, 1167 and 1660-1665, Bighorn RMP FEIS pg. 4-642— 4-674, and Lander RMP FEIS pg. 1276-1332 for more information on what activity was considered in the RMP cumulative impacts analysis.

In particular, in its analysis of impacts of impacts from oil and gas development, the ARMPA at page 4-508, concludes:

Loss of vegetation from development activities would degrade habitat and increase forage competition among grazing animals. Livestock grazing practices would further increase cumulative impacts through direct competition for forage, water, and space, and by limiting the ability to manage vegetation for fish and wildlife needs. These impacts would also reduce the capability to maintain current population objectives.

Oil and gas development would cause the greatest amount of surface disturbance through construction of well pads, roads, pipelines, and other facilities. Reclamation and mitigation efforts would reduce impacts on wildlife habitat and fisheries; however, construction and maintenance of roads and well pads and the presence of humans would result in long-term or permanent impacts. Cumulative impacts would likely be greater where mineral development is more intense, in areas where development overlaps with crucial and winter wildlife ranges, and on state and private lands because of the lack of protections afforded to natural resources in these areas. Protection of non-federally listed species on private and state lands may not occur, resulting in potentially significant impacts on these species. As development expands throughout southwestern Wyoming, the ability of big game species to disperse into habitats outside of the planning area may become limited. This may create isolated populations in areas where habitats remain intact. The degree of impact would depend on the timing of development activities and whether the amount of activity outpaces the successful reclamation and revegetation efforts in disturbed areas. Because of this pace of development (whether federal mineral, commercial, or private residence), more pressure would be put on habitats outside of the development (likely private lands) as wildlife is displaced from the disturbances.

Impacts on wildlife would likely occur under all alternatives because of the loss of habitat. The success of disturbed land reclamation, both short- and long-term, would determine the duration of impacts. Given the

constancy of all other stressors, the potential for cumulative impacts would be greatest under Alternative A because of anticipated increases in development and fewer restrictions on such activity on public lands.

There are no pending APD actions for any of the proposed parcels. Potentially significant impacts to migration and big game habitats were forecast to occur as a result of development in the approved project areas. These parcels would contribute and potentially expand the environmental effects. Within the Green River RMP FEIS (at 462) impact analysis indicates that “the capability of habitat to meet herd unit objective levels would likely be significantly affected” in the Sublette HU. Development of parcels in combination with other existing and/or future development could contribute to these significant impacts.

Where parcels are located outside of approved project areas, and if they are developed, an increase in exploratory activity could occur if conditions are favorable. Due to the scattered nature of the parcels, this activity could occur where there is little to no development currently. Due to the fractured nature of the fluid mineral estate in the HPD and in SE WY, most development is being sited on private or state lands resulting in off-lease federal production. In these cases, the State of Wyoming has primary jurisdiction for ensuring operations are compliant with state rules for the protection of surface lands.

The likelihood of an Increase in activity in the HDD is likely low while continued exploratory and some development activity increases in the HPD. Exploratory and development activity could increase in the WR/BBD due to the number of previously nominated parcels, however, it is unknown as to what extent. Typically, less than 50% of all leases issued are explored. Further information concerning BLM leasing statistics can be located at: <https://www.blm.gov/programs-energy-and-minerals-oil-and-gas-oil-and-gas-statistics>. To the extent that existing oil and gas development is affecting big game herds, those impacts are expected to continue. New development is likely to be consistent with current projections in the RMPs and are not expected to be at a level that would cause significant impacts beyond those reflected in the RMP FEIS’. Impacts from other risk factors, such as severe weather events, are expected to continue but cannot be foreseen. Based on the analysis above, and in consideration of new information, no new impacts have been identified and the need for new or revised stipulations are not necessary to mitigate potential future effects.

Best management practices will be considered and where required by stipulation, a mitigation plan will be developed to ensure that RMP objectives are achieved. Lease Notices and coordination with State Agencies will ensure cooperation and coordination across jurisdictions, increasing the consistency in application of mitigation and consideration of cumulative impacts. Master development plans will be considered as appropriate. Conditions at the time an APD is submitted will be assessed for significance; the need for additional mitigation will also be determined at the time development is proposed. All future projects will under-go site-specific review, and preparation of an environmental record of review will occur in accordance with Federal law, regulation, and policy. All oil and gas projects in the state are subject to State of Wyoming rules and require approval of an Application for Permit to Drill by both agencies if the proposal involves production of the Federal mineral estate. Monitoring and the use of adaptive management will continue in accordance with any applicable decision. As data is collected and made available, it will be considered at the time development is proposed, if a parcel is sold, a lease is issued and development proposed.

In consideration of the above, no significant cumulative impacts are expected from the offering of the parcels that contain big game habitats.

4.5 Lands with Wilderness Characteristics

4.5.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, the Proposed Action or alternatives would not be authorized and BLM Wyoming would not offer any of the 5 parcels nominated. Ongoing oil and gas development, ranching, recreation, and other activities on BLM-administered lands would continue.

4.5.2 Alternative 2 – Proposed Action

Under Alternative 2, no parcel is located either wholly or partially within LWC areas. None of the parcels are proposed in the Citizen Proposed Wilderness areas (CWPs). See section 3.6 for more information on the Citizen Proposed Wilderness (CPW) area.

4.5.3 Cumulative Impacts

Cumulative impacts to LWCs are described in each Field Office RMP.

4.6 Socioeconomics and Environmental Justice

4.6.1 Alternative 1 – No Action Alternative

Under the No Action Alternative, where none of the leases would be offered and subsequently sold, the employment, revenue, and purchasing opportunities associated with developing and producing wells on these leases would be foregone, as would the opportunity to provide oil and gas resources from these lease parcels to aid in meeting associated energy demands. None of the proposed parcels would be offered for lease, resulting in reduced bonus bid revenues and rentals. Since not leasing these minerals would prevent private entities from exploring and developing these minerals, subsequent associated oil and gas production and generation of royalty revenues would not occur. The State of Wyoming, as well as many counties and communities within, rely on oil and gas development as an important part of their economic base for funding a majority of public services and livelihoods. However, adverse impacts to quality of life associated with future potential lease developments, such as impacts to air quality, water quality, biodiversity, cultural resources, non-use values and recreation values, would also be foregone.

See discussion in Section 4.1 about the short-term energy outlook about projections on U.S. energy portfolio.

For more detailed, management area-specific discussions regarding the potential impacts of foregoing leasing, please refer to the applicable RMP FEISs.

4.6.2 Alternative 2 – Proposed Action

4.6.2.1 Socioeconomics

At the lease sale stage, it is unknown where, or if, development would occur in any given nominated lease parcels; as specific types and locations of development are proposed, their specific effects would be analyzed and addressed in detail at the time of proposed lease development. However, in general, acquisition and development of new leases provide short-term local and regional jobs and long-term revenue on a sustained basis. These may include employment opportunities related to the oil and gas and service support industries in the region, as well as federal, state, and county government revenue related to taxes, royalty payments, and other revenue streams.

Federal oil and gas leases generate a one-time lease bonus bid, as well as annual rents during the life the lease, or until hydrocarbon production begins on the leased parcel. Nominated parcels approved for leasing are offered quarterly by the BLM at auctions starting at a minimum bid of \$10.00 per acre. If parcels do not receive the minimum competitive bid, they may be offered at a later sale or cancelled. In general, lease sales in Wyoming are highly competitive and parcels with high potential for oil and gas production regularly command bonus bids in excess of the minimum bid.

Lessee rent payments are equal to \$3.00 an acre for the first two years and increase to \$5.00 an acre for six further years of the lease. For any lease extending beyond the first eight years, rent payments increase to at least \$15.00 per acre thereon. Typically, these leases expire after 10 years unless held by production. During this lease period, annual rental payments are paid on leased parcels until one or more wells are drilled that result in production, then the lessee begins paying annual royalties calculated as a percentage of the value of production from the parcel. For this sale, the BLM is updating the sale notice and including an attachment to the standard lease form applying a 16.67% royalty rate. 51% of federal mineral leasing revenues go to the Treasury Department, while approximately 49% are

distributed back to the state in which the revenues were generated. In Wyoming, federal mineral receipts distributed back to the state follow a legislatively established, two-tier formula. The first tier covers total annual receipts up to \$200 million and the second tier applies to receipts over \$200 million per year. Based on the state's established two-tier formula, Wyoming allocates these revenues to public school districts, the highway and county road fund, cities and towns, the University of Wyoming, capital construction projects, and the state's budget reserve account (WY LSO 2023).

Although the economic activity associated with mineral development plays an important role in supporting the overall socioeconomic well-being of Wyoming communities and their public services, such resource development can have adverse impacts on other, equally valued socioeconomic indicators, such as recreation (including hunting, fishing, and wildlife viewing), cultural resource preservation (including traditional ecological knowledge sharing), livestock grazing, and public health factors such as air quality. Continued expansion of the oil and gas industry may be perceived as having a negative effect on quality-of-life values associated with these indicators. To the extent that additional oil and gas development affect recreational, tourism, agricultural, educational, or preservation opportunities in the area of the nominated lease parcels, there may be related direct and indirect regional economic effects to associated local industry suppliers and support services.

The total landscape-level surface disturbance associated with reasonably foreseeable environmental trends and planned actions would include activities that generate increased human activity, traffic, noise, dust, odor, light and air pollution, and visual effects. These activities have the potential to affect quality of life of any existing nearby residences or facilities, depending on the intensity of development activities and proximity of structures to a given parcel. While the majority of these impacts to any significantly proximal residences or facilities would be short term and cease during operations (e.g., increased human activity, traffic, noise, dust, and odor during drilling and completion phases), residences may continue to experience longer-term visual, air, or other impacts that have potential to affect quality of life if they are located in areas in which oil and gas development is not currently nearby or visible. However, with consideration of total lease acreage, topography, and resources present within the nominated lease parcels, there are opportunities for future potential development to be placed in portions of the nominated lease parcels that are less proximal to any associated residences and facilities.

Air pollution can also impact Air Quality Related Values through ambient exposure to elevated atmospheric concentrations, such as ozone effects to vegetation, impairment of scenic views by particulate matter in the atmosphere, and deposition of air pollutants, such as sulfur and nitrogen compounds, on the Earth's surface through dry and wet precipitation.

Regarding water quality, traditional oil and gas resource exploration, development, and production typically do not significantly deplete ground water on a regional basis but may have a limited, short-duration, near-well bore drawdown around the water supply well depending upon length and intensity of pumping activity. Further discussion on water quality can be found in Section 5.2.2

Other economic or social indicators can also influence the general health risks of a population, such as poverty status, educational attainment, broadband access or language proficiency. The intensity, and likelihood, of potential impacts to public health and safety, including the quality of usable water aquifers, is directly related to proximity of the proposed action to domestic and/or community water supplies (wells, reservoirs, lakes, rivers, etc.) and/or agricultural developments. Groundwater resources are also regional in nature and water withdrawals are not anticipated to affect domestic water sources (see Section 3.3 and 4.2 for water resource discussions). Any impacts to local water wells (for example, a spill that affects groundwater) could force residents to find other means of supplying water for domestic or agricultural use. Best Management Practices (BMPs) and Conditions of Approval (COAs) to an APD would be implemented to minimize this risk. Should a spill occur, the BLM would work with operators to immediately remediate spills in accordance with federal and state standards.

Due to the scattered nature and small area encompassed by the proposed parcels (as well as low population density and the presence of industrial safety programs, standards, and state and federal regulations) offering the proposed parcels is not expected to substantially increase health or safety risks to humans, wildlife, or livestock. Parcels that contain lands with private surface overlying federal minerals (i.e., split estate) have, or have the potential to, contain private residences and associated facilities such as domestic water supply wells. Several of these parcels may also be

used for individual dispersed recreational activities which could expose these users to oil and gas-related activity, as mentioned previously.

4.6.2.2 Environmental Justice

For minority populations, the BLM generally defines “meaningfully greater” as 10 percent above the minority population size of the comparison geography. A low-income population is identified by the BLM as a community of concern if either 1) low-income populations of the area of analysis exceed 50% of the population, or 2) the low-income population is less than or equal to twice (200%) of the federal “poverty level.” Indigenous communities of concern are present if the percentage of the population identified as indigenous, including non-tribal-affiliated persons who identify as indigenous or a combination of indigenous and another ethnicity, is equal to or greater than that of the reference population (see Federal Interagency Working Group on Environmental Justice and NEPA Committee 2016; BLM EJ Implementation IM 2022-059) Persons with disabilities considers six disability types: hearing difficulty, vision difficulty, cognitive difficulty, ambulatory difficulty, self-care difficulty, and independent living difficulty. Respondents who report any one of the six disability types are considered to have a disability. No threshold has been defined for persons with disabilities. The disability type is not identified and all are combined into a single total. Based on such guidance, the BLM identified the Census tract block group containing the proposed parcels and disability, low income, minority, and/or indigenous populations in one Wyoming county (Table 4-10).

For this EA, the EJ analysis area is defined as all US Census block groups surrounding the associated parcels proposed to be offered for sale in each Alternative. Block groups are the smallest geographic areas for which the U.S. Census Bureau provides sample data and typically contain between 600 and 3,000 people. The parcels offered for sale are located in the Casper Field Office within Converse County. If a parcel is located on or adjacent more than one block group, all proximal and/or immediately adjacent block groups were also included in the analysis. The nearest block groups for this analysis are more than half a mile away so only the block group containing the parcels was included in the analysis. Adjacent block groups were considered, however. Adjacent block groups would be included to represent geographies proximal to the management area, associated potential transportation and access routes, and to be inclusive of regional rural and indigenous landscapes.

Parcels offered for sale are located in Converse County, Wyoming. The population of the block group containing all the parcels totals 1,045 people (USCB 2022). The reference area is the State of Wyoming for all Wyoming parcels; reference areas smaller than the state of Wyoming are not suitable for this analysis due to the rural composition and resulting sparse demographic data available at a consistent county level. Based on these criteria, potential communities of concern were identified in census block groups of the following counties:

Table 4-10. Alternative 2 Environmental Justice Screening Criteria Results

Parcel #	County	BG Meets Singular EJ Screening Criteria with State Reference	BG Meets Multiple EJ Screening Criteria with State Reference	Disability	Parcel Area (Acres)	US Census Block Group Area (Acres)
1927	Converse County	No	No	9%	80.0	1,723,727
2006	Converse County	No	No	9%	320.0	1,723,727
7319	Converse County	No	No	9%	323.1	1,723,727
1926	Converse County	No	No	9%	1720.01	1,723,727

Sources: BLM and Headwaters Economics Socioeconomic Profiling Tool (US DOC 2022), U.S. Census Bureau American Community Survey (USCB 2022)

Potential low-income, minority, and indigenous block group populations are not identified within the study area containing the proposed lease parcels. No populations were identified that may be disproportionately affected by project actions if proximal to a parcel that is then developed or employed (or supported) by oil and gas extractive industries and/or support industries. No block group populations were identified that would warrant special attention, outreach, and meaningful involvement to investigate any past, present, or future disproportionalities that

could be associated with an associated future APD. It is estimated that approximately 13% of the total study area population (i.e., the sum of all block group populations that contain proposed parcels) is identified as low-income. This is less than the reference area low-income percentages of 26% for WY. It is estimated that approximately 11% of the study area population is identified as belonging to a minority population group. This is less than the reference area minority percentage of 16% for WY. It is estimated that approximately 0% of the study area population is identified as belonging to an indigenous population group. This is less than the reference area indigenous percentage of 2% for WY. The screening identified that 9.2% of Wyoming's population are persons with disabilities, which is nearly the same as the 9% identified in the block group.

It is important to note that Wyoming populations, even the identified Environmental Justice populations (EJ), rely heavily on economic contributions from the oil and gas industry--whether it be in the form of employment, funding for public services, or indirect funding of related industry support services. As such, economic fluctuations associated with oil and gas development decisions are also felt disproportionately by existing identified EJ populations.

Low-income, disabled, minority, and indigenous communities of potential concern constitute populations at risk for adverse health outcomes due to demographic and/or socioeconomic factors (US DOC 2022). The EPA has concluded that the most severe harms from climate change fall disproportionately upon underserved communities who are least able to prepare for, and recover from, heat waves and drought, poor air quality, flooding, wildfires, and other impacts (EPA 2021b). Aside from disability, ethnicity, and poverty status, other factors contributing to increased risks for potential communities of concern in the analysis area include, but are not limited to, age, education, employment, broadband access, and language proficiency. Public health impacts described in Sections 3.6.3 and 4.6.2.3 would be similar in context but disproportionately adverse to EJ populations when compared to the total population being generally affected.

If the proposed parcels are leased, and subsequently if the lessee submits an APD, identified potential communities of concern would be provided opportunities to identify any perceived adverse environmental impacts at the time of site-specific analysis during the APD stage. No potential communities of concern were identified during this analysis. While the identification of potential adverse and disproportionate effects from specific actions may initially be the assessment of the BLM, this assessment should not be assumed to be the position of specific, potentially affected communities of concern. The BLM realizes that additional adverse impacts could be identified by local communities and Tribes as specific development locations and types are proposed.

This discussion, therefore, assesses only the effects for the issues identified by the BLM during scoping and public comment periods (see Sections 1.6 and 1.7). The BLM would continue to work with potentially affected communities to identify and address additional disproportionate effects if the proposed parcels are leased, and the lessee submits an APD. .

4.6.2.3 Public Health and Safety

While no formal human health risk assessments have been conducted specific to past and present development in the BLM WY management area, the results of EPA's 2019 Air Toxics Screening Assessment (AirToxScreen) indicate that cancer, neurological risks, and respiratory risks in the analysis area are all lower than national levels and are generally the same as state of Wyoming levels (EPA 2019) (refer to Sections 3.1 and 4.1).

While the 2019 AirToxScreen estimates the risk of cancer and/or other health impacts solely based on exposure to HAPs, other economic or social indicators can also influence the general health risks of a population, such as poverty status, educational attainment, or language proficiency. Headwaters Economics data for populations at risk (i.e., more likely to experience adverse health outcomes because of demographic or socioeconomic factors) show that most of the indicators for populations at risk are lower for the state of Wyoming compared with the nation as a whole. However, low-income, minority, and indigenous communities of potential concern within the analysis area (Section 4.6.2.2) constitute populations at risk for adverse health outcomes due to demographic and/or socioeconomic factors (US DOC 2022). Aside from ethnicity and poverty status, other factors contributing to increased risks for populations in the analysis area include, but are not limited to, age, education, employment, broadband access, and language proficiency. Human health risk assessments cannot be performed until project-specific details are known so that frequency, timing, and levels of contact with potential stressors may be identified

(EPA 2022g). However, each of the reasonably foreseeable environmental trends and planned actions have been, or will be, subject to relevant rules and regulations regarding public health and safety. Ongoing and future potential development would continue to present aggregate risks to human health as detailed above. When wells reach the end of their useful life and are properly plugged and reclaimed, they would no longer contribute to air quality effects; however, depending on the level and duration of individual's exposure during well operation, some of the public health effects from air pollution may endure beyond the life of the wells (e.g., chronic respiratory problems such as asthma).

Future potential development on the nominated lease parcels is estimated to be nine wells for this lease sale, based on emissions estimated using the BLM Lease Sale Emissions Tool based on the total acreage of the lease parcels and the 5-year average of the number of lease acres held by production divided by the total acres leased and discussed in Section 5.1.3. Of the four nominated lease parcels, two parcels indicate building block footprints that occur within 0.5 miles of the parcel boundary; all four parcels indicate building block footprints that occur within 1.25 miles of the parcel boundary and all four parcels indicate building block footprints that occur within 2.5 miles of the parcel boundary. Residences that occur within 1.25 miles or less from oil and gas development are generally at a higher risk for experiencing air pollution effects (Adgate et al. 2014; Czolowski et al. 2017; Haley et al. 2016; Kroepsch et al. 2019) and residences within 0.5 miles or less from oil and gas development is where noise and odor effects may reach nuisance levels, depending on the phase of development (Adgate et al. 2014; Blair et al. 2018; Hays et al. 2017; Kroepsch et al. 2019). None of the nominated lease parcels are 2.5 miles or greater from any observed building block footprints and would be at lower risk for contributing health and safety related impacts from any future potential development. All identified building footprints occurring within 1.25 miles of parcel boundaries, while spatially proximal, are attributable to rural, remote, and sparsely populated US Census Bureau block groups whose actual building residency statuses or associated levels of use or access are unknown at this time.

When authorizing development, federal and state laws, regulations, and policy are applied to reduce effects or respond to incidents. These include the following:

- Federal, state, county, and municipal fire managers shall coordinate on fire response and mitigation.
- Developers who install and operate oil and gas wells, facilities, and pipelines are responsible for complying with the applicable laws and regulations governing hazardous materials and for following all hazardous spill response plans and stipulations. The Wyoming Oil and Gas Conservation Commission (WYOGCC) requires similar spill response measures after release of hydrocarbons, produced water, or hydraulic fracturing fluids.
- All well pads, vehicles, and other workplaces must comply with worker safety laws as stipulated by the Occupational Safety and Health Administration.
- Vehicular traffic and pipelines are regulated according to safety laws as stipulated by the Department of Transportation.
- Measures to lower risks related to H₂S exposure include flaring or venting gas and the use of stock tank vapor recovery systems.
- Fugitive dust is concentrated in the short-term during construction but may occur to a lesser degree in the long term because of increased vehicle use and ground disturbance. In addition to fugitive dust, refer to the air quality analysis in Section 4.1.2 for estimated emissions of other air pollutants, including criteria pollutants, VOCs, and HAPs. Dust is concentrated in the short-term during construction but may occur to a lesser degree in the long term because of increased vehicle use and ground disturbance. In addition to fugitive dust, refer to the air quality analysis in Section 4.1.2 for estimated emissions of other air pollutants, including criteria pollutants, VOCs, and HAPs.

4.6.3 Cumulative Impacts

4.6.3.1 Socioeconomics

Overall impacts would likely be greater where mineral development is more intense, in areas where development overlaps with crucial and winter wildlife ranges, and on state and private lands because of the lack of protections afforded to natural resources in these areas. If development expands, the ability of big game and other wildlife species to disperse into alternate habitats could become limited. This may create isolated populations in areas where

habitats remain intact. While multiple, overlapping timing stipulations can provide benefit to wildlife resources by preventing sustained disruptive activity, the Pinedale RMP FEIS, p 4-60 (2006), also notes “[W]hen areas with greater sage-grouse nesting restrictions overlap areas with big game crucial winter range restrictions, the oil and gas operator would potentially be restricted to a 3-and-a-half-month construction, drilling, and well completion season. This short drilling and development window in areas such as the Pinedale Anticline has led to accelerated operations, which results in congested traffic on primary access roads and a potential overload on local service and emergency resources. It also causes a yearly bust-and-boom cycle for the local communities as crews move in during the open development window then leave when the seasonal restrictions are invoked.” This situation can be exacerbated when lease development is further reduced by other seasonal restrictions, including those for raptors.

Fugitive dust is concentrated in the short-term during construction but may occur to a lesser degree in the long term due to increased vehicle use and ground disturbance. In addition to fugitive dust, see Section 3.1 Air Resources for a comprehensive description of existing health and climate impacts and trends of other air pollutants, including criteria pollutants, VOCs, and HAPs. While any climate change-related effects from the future potential development of the parcels themselves would be minimal, climate change is the result of collective and global actions. Any climate change-related impact would be regional in nature but may still disproportionately affect individuals within potential communities of concern in the analysis area who are already vulnerable (EPA 2021b), in addition to the general population. Key weather and climate drivers of health impacts include increasingly frequent, intense, and longer lasting extreme heat, which worsens drought, wildfire, and air pollution risks; increasingly frequent extreme precipitation, intense storms, and changes in precipitation patterns that lead to drought and ecosystem changes.

Other economic or social indicators can also influence the general health risks of a population, such as poverty status, educational attainment, broadband access or language proficiency. The intensity, and likelihood, of potential impacts to public health and safety, including to the quality of usable water aquifers, is directly related to proximity of the proposed action to domestic and/or community water supplies (wells, reservoirs, lakes, rivers, etc.) and/or agricultural developments. Groundwater resources are also regional in nature and water withdrawals are not anticipated to affect domestic water sources (see Section 3.3 and 4.2 for water resource discussions). Any impacts to local water wells (for example, a spill that affects groundwater) could force residents to find other means of supplying water for domestic or agricultural use. Best Management Practices (BMPs) and Conditions of Approval (COAs) to an APD would be implemented to minimize this risk. Should a spill occur, the BLM would work with operators to immediately remediate spills in accordance with federal and state standards.

Continued expansion of the oil and gas industry may be perceived as having a negative effect on quality-of-life considerations for people who value undeveloped landscapes, opportunities for isolation, and activities such as cultural practices, wildlife viewing and other forms of recreation, or rangeland management. The total landscape-level surface disturbance associated with reasonably foreseeable environmental trends and planned actions would include activities that generate increased human activity, traffic, noise, dust, odor, light pollution, and visual effects. These activities have the potential to affect quality of life of any existing nearby residences or facilities, depending on the intensity of development activities and proximity of structures to a given parcel. While the majority of these impacts to any significantly proximal residences or facilities would be short term and cease during operations (e.g., increased human activity, traffic, noise, dust, and odor during drilling and completion phases), residences may continue to experience long-term visual or other impacts that have potential to affect quality of life if they are located in areas in which oil and gas development is not currently nearby or visible. However, with consideration of total lease acreage, topography, and resources present within the nominated lease parcels, there are opportunities for future potential development to be placed in portions of the nominated lease parcels that are less proximal to any associated residences, populations, and facilities, thereby minimizing potential associated quality of life impacts.

The BLM uses a number of stipulations and lease notices applied to the nominated lease parcels in the current sale that may mitigate potential effects on wildlife and other resources that in turn may mitigate effects on related concerns (see Appendices sections 5.1 and 5.2 for specific stipulations and lease notices applied to the nominated lease parcels, and individual stipulation and lease notice summaries). Under the authority granted in standard terms and conditions attached to each lease, measures to reduce or avoid impacts to resource values, land uses, or users would be attached as COAs to the associated APD. Site-specific avoidance, minimization, and/or mitigation measures would be determined at the time of proposed lease development. This could include measures to reduce noise, dust, odor, and light effects during construction and operations. As with reasonably foreseeable environmental

trends and planned actions, effects to quality of life and other socioeconomic values from these trends and actions would be examined at the APD level with consideration of site-specific locational information and development of COAs to reduce identified effects as needed.

4.6.3.2 Environmental Justice

Cumulative health related impacts to potential environmental justice populations would be similar in context, but more disproportionate and adverse in nature, than those discussed in the Affected Environment.

It is important to note that Wyoming populations, even potential communities of concern, rely heavily on economic contributions from the oil and gas industry--whether it be in the form of employment, funding for public services, or indirect funding of related industry support services. As such, economic fluctuations associated with oil and gas development decisions are also felt disproportionately by existing identified EJ populations. The federal government cannot dictate where oil and gas reserves may exist. Consequently, there may be instances where oil and gas activities disproportionately and adversely affect communities of concern due to development proximity and associated factors discussed in the Public Health and Safety section. Oil and gas exploration activities can be active for variable amounts of time. For example, a typical horizontal well averages from 30 to 60 days from start of drilling to completion and may have a greater effect (increased dust, traffic, etc.) on resident populations in close proximity to such drilling operations while the drilling operations are ongoing. These kinds of exploration activities may result in impacts that are adverse to communities of concern; however, the BLM does not know exactly where drilling operations may take place until lease development is proposed, if a nominated lease parcel is developed at all. Additional review would be conducted at the time of proposed lease development, accompanied by an associated EJ determination. Standard terms and conditions attached as COAs to the APD could include measures to reduce effects on nearby communities of concern. Under the Oil and Gas Leasing Regulation for Surface Use Rights (43 CFR § 3101-12), such reasonable measures may include modification to siting or design of facilities, including relocation of proposed operations up to 800 m. These measures could minimize potential impacts that could be adverse and disproportionate to members of communities of concern, as well as the general population.

BLM Wyoming uses stipulations and COAs to minimize effects to nearby populations, including potential communities of concern, during construction and operations, to the extent practicable. Note that any residence, community facility or gathering space in an area with a community of concern has the chance of being significant to that community; however, no such places have been identified within the nominated lease parcels. Additionally, no specific Native American resource concerns have been identified on the subject lease parcels; however, Tribal consultation and EJ meaningful involvement are considered ongoing, where issues or concerns previously unknown could be brought forward at any time. Currently, impacts to potential communities of concern are more likely to be indirect and may incrementally contribute to impacts associated with reasonably foreseeable environmental trends and planned actions. Cumulative health related impacts to potential environmental justice populations would be similar in context, but more disproportionate and adverse in nature, than those discussed in the Affected Environment.

4.6.3.3 Public Health and Safety

Fugitive dust is concentrated in the short-term during construction but may occur to a lesser degree in the long term due to increased vehicle use and ground disturbance. In addition to fugitive dust, see Section 3.1 Air Resources for a comprehensive description of existing health and climate impacts and trends of other air pollutants, including criteria pollutants, VOCs, and HAPs. While any climate change-related effects from the future potential development of the parcels themselves would be minimal, climate change is the result of collective and global actions. Any climate change-related impact would be regional in nature but may still disproportionately affect individuals within potential communities of concern in the analysis area who are already vulnerable (EPA 2021b), in addition to the general population. Key weather and climate drivers of health impacts include increasingly frequent, intense, and longer lasting extreme heat, which worsens drought, wildfire, and air pollution risks; increasingly frequent extreme precipitation, intense storms, and changes in precipitation patterns that lead to drought and ecosystem changes. Key drivers of vulnerability include the attributes of certain groups (age, socioeconomic status, race, and current level of health) and of place (floodplains, coastal zones, and urban areas), as well as the resilience of critical public health infrastructure. Health effects of these disruptions include increased respiratory and cardiovascular disease, injuries, and premature deaths related to extreme weather events; changes in the prevalence

and geographical distribution of foodborne and waterborne illnesses and other infectious diseases; and threats to mental health. Milder winters resulting from a warming climate can reduce illness, injuries, and deaths associated with cold and snow. Vulnerability to winter weather depends on many non-climate factors, including housing, age, and baseline health. Although deaths and injuries related to extreme cold events are projected to decline due to climate change, these reductions are not expected to compensate for the increase in heat-related deaths. The frequency of heavy precipitation events has already increased for the nation as a whole and is projected to increase in all U.S. regions. Increases in both extreme precipitation and total precipitation have contributed to increases in severe flooding events in certain regions. In addition to the immediate health hazards associated with extreme precipitation events when flooding occurs, other hazards can often appear once a storm event has passed. Water intrusion into buildings can result in mold contamination that manifests later, leading to indoor air quality problems.

The intensity, and likelihood, of potential impacts to public health and safety, including to the quality of usable water aquifers, is directly related to proximity of the proposed action to domestic and/or community water supplies (wells, reservoirs, lakes, rivers, etc.) and/or agricultural developments as well as regional population density. Groundwater resources are also regional in nature and water withdrawals are not anticipated to affect domestic water sources (see Section 3.3 and 4.2 for water resource discussions). Any impacts to local water wells (for example, a spill that affects groundwater) could force residents to find other means of supplying water for domestic or agricultural use. Best Management Practices (BMPs) and Conditions of Approval (COAs) to an APD would be implemented to minimize this risk. Should a spill occur, the BLM would work with operators to immediately remediate spills in accordance with federal and state standards.

Potential cumulative impacts are also dependent on the extent of the production well's capture zone and well integrity. Standard Lease Notice No.1 specifies that development is generally restricted within a quarter mile of occupied dwellings and within 500 feet of riparian habitats and wetlands, perennial water sources (rivers, springs, water wells, etc.) and/or floodplains. Intensity of impact is likely dependent on the density of development. Further information related to the rate of development is provided in Section 1. Human health risk assessments cannot be performed until project-specific details are known so that frequency, timing, and levels of contact with potential stressors may be identified (EPA 2021h). However, each of the reasonably foreseeable environmental trends and planned actions have been, or will be, subject to relevant rules and regulations regarding public health and safety.

Ongoing and future potential development would continue to present aggregate risks to human health as detailed above and in previous chapters and sections. When wells reach the end of their useful life and are properly plugged and reclaimed, they would no longer contribute to air quality effects; however, depending on the level and duration of individual's exposure during well operation, some of the public health effects from air pollution may endure beyond the life of the wells (e.g., chronic respiratory problems such as asthma). Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad" (January 27, 2021), directs the executive branch to establish policies or rules that put the United States on a path to achieve carbon neutrality, economywide, by no later than 2050. This goal is consistent with IPCC's recommendation to reduce net annual global CO emissions between 2020 and 2030 in order to reach carbon neutrality by mid-century. Federal agencies are still in the process of developing policies that align with a goal of carbon neutrality by 2050. In the short-term, the order has a stated goal of reducing economy-wide GHG emissions by 50 to 52% relative to 2005 emissions levels no later than 2030.

While continued fossil fuel authorizations will occur over the next decade to support energy demand and remain in compliance with the leasing mandates in the Inflation Reduction Act (IRA) passed in 2022, the U.S. Energy Information Administration International Energy Outlook expects renewable energy consumption to double between 2020 and 2050 and nearly equal liquid fuels consumption by 2050. The U.S. has committed to the expansion of renewable energy through infrastructure investments in clean energy transmission and grid upgrades include in the Bipartisan Infrastructure Investment and Jobs Act as well as clean energy investments and incentives included in the Inflation Reduction Act. The Department of Energy's Office of Policy developed a preliminary assessment that finds the IRA and BIL, in combination with past actions, are projected to reduce 2030 economy wide GHG emissions to 40% below 2005 level, even with continued oil and gas leasing in the near term.

https://www.energy.gov/sites/default/files/2022-08/8.18%20InflationReductionAct_Factsheet_Final.pdf.

5 Appendices

5.1 Lease Sale Parcel List with Proposed Stipulations and Noted Deletions/Deferrals

WY-2025-03-1927 Split Estate

WY, Casper Field Office,
Bureau of Land Management,
PD

T. 36 N., R. 69 W., SIXTH
PRINCIPAL

Sec. 25 S1/2SE1/4.

Converse County

80 Acres

16.670% Royalty Rate

Stipulations:

HQ-CR-1

BLM Lease Notice for Cultural
Resource Protection

HQ-MLA-1

BLM Lease Notice for Notice to
Lessee Concerning Mineral
Leasing Act Section 2(a)(2)(A)

HQ-TES-1

BLM Lease Notice for
Threatened and Endangered
Species Act

WY STD LEASE NOTICE NO. 1

BLM Lease Notice for
Reasonable Measures to
Minimize Adverse Impacts to
Resources

WY STD LEASE NOTICE NO. 2

BLM Lease Notice for National
Historic Trails

WY STD LEASE NOTICE NO. 3

BLM Lease Notice for Greater
Sage-Grouse Habitat

WY STD LEASE STIPULATION NO. 3

BLM Stipulations for Multiple
Mineral Development
EOI# WY00019221

WY-2025-03-2006 Split Estate

WY, Casper Field Office,
Bureau of Land Management,
PD

T. 35 N., R. 70 W., SIXTH
PRINCIPAL

Sec. 14 W1/2SW1/4,

SE1/4SW1/4;

Sec. 22 W1/2SE1/4,

SE1/4SE1/4;

Sec. 27 N1/2NW1/4.

Converse County

320 Acres

16.670% Royalty Rate

Stipulations:

HQ-CR-1

BLM Lease Notice for Cultural
Resource Protection

HQ-MLA-1

BLM Lease Notice for Notice to
Lessee Concerning Mineral
Leasing Act Section 2(a)(2)(A)

HQ-TES-1

BLM Lease Notice for
Threatened and Endangered
Species Act

WY CFO_TLS_NR

BLM Stipulations for Nesting
Raptors

WY STD LEASE NOTICE NO. 1

BLM Lease Notice for
Reasonable Measures to
Minimize Adverse Impacts to
Resources

WY STD LEASE NOTICE NO. 2

BLM Lease Notice for National
Historic Trails

WY STD LEASE NOTICE NO. 3

BLM Lease Notice for Greater
Sage-Grouse Habitat

WY STD LEASE

STIPULATION NO. 3

BLM Stipulations for Multiple
Mineral Development
EOI# WY00019257

WY-2025-03-7319 Split Estate

WY, Casper Field Office,
Bureau of Land Management,
PD

T. 41 N., R. 71 W., SIXTH
PRINCIPAL

Sec. 31 LOTS 5, 6, 11 thru 14,
19, 20.

Converse County

323.1 Acres

16.670% Royalty Rate

Stipulations:

HQ-CR-1

BLM Lease Notice for Cultural
Resource Protection

HQ-MLA-1

BLM Lease Notice for Notice to
Lessee Concerning Mineral
Leasing Act Section 2(a)(2)(A)

HQ-TES-1

BLM Lease Notice for
Threatened and Endangered
Species Act

WY CFO_TLS_NR

BLM Stipulations for Nesting
Raptors

WY STD LEASE NOTICE NO. 1

BLM Lease Notice for
Reasonable Measures to
Minimize Adverse Impacts to
Resources

WY STD LEASE NOTICE NO. 2

BLM Lease Notice for National
Historic Trails

WY STD LEASE NOTICE NO. 3

BLM Lease Notice for Greater
Sage-Grouse Habitat

WY STD LEASE

STIPULATION NO. 3

BLM Stipulations for Multiple
Mineral Development
EOI# WY00019251

WY-2025-03-1926 Split Estate

WY, Casper Field Office,
Bureau of Land Management,
PD

T. 36 N., R. 74 W., SIXTH
PRINCIPAL

Sec. 1 LOTS 5 thru 12, 15 thru
18;

Sec. 3 LOTS 5 thru 11;

Sec. 3 NE1/4SW1/4;

Sec. 10 LOTS 1 thru 3, 6 thru 8,
10, 11, 14;

Sec. 14 LOTS 1, 2, 4 thru 15.

Converse County

1720.01 Acres

16.670% Royalty Rate

Stipulations:

HQ-CR-1

BLM Lease Notice for Cultural
Resource Protection

HQ-MLA-1

BLM Lease Notice for Notice to
Lessee Concerning Mineral
Leasing Act Section 2(a)(2)(A)

HQ-TES-1

BLM Lease Notice for
Threatened and Endangered
Species Act

WY CFO_CSU_BT3

BLM Stipulations for Bozeman
Trail Cultural and Scenic Values

WY CFO_CSU_BTQTRM

BLM Stipulations for Bozeman
Trail Cultural and Scenic Values

WY CFO_TLS_NR

BLM Stipulations for Nesting
Raptors

WY STD LEASE NOTICE

NO. 1

BLM Lease Notice for
Reasonable Measures to
Minimize Adverse Impacts to
Resources

WY STD LEASE NOTICE

NO. 2

BLM Lease Notice for National
Historic Trails

WY STD LEASE NOTICE

NO. 3

BLM Lease Notice for Greater
Sage-Grouse Habitat

WY STD LEASE

STIPULATION NO. 3

BLM Stipulations for Multiple
Mineral Development

EOI# WY00019252

5.2 Lease Stipulation Code Index

STIPULATION CODE	STIPULATION LANGUAGE
WY_BFO_CSU_BEGE	<p>CSU (1) Prior to surface disturbance within 1.0 mile of consistently used bald and golden eagle winter roosts and riparian corridors a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer’s satisfaction that wintering eagles will not be disturbed (as defined by the Bald and Golden Eagle Protection Act). Bald or golden eagles will not be agitated or bothered to a degree that causes or is likely to cause physical injury, or a decrease in productivity by substantially interfering with normal breeding, feeding, or sheltering behavior; (2) as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) protecting bald and golden eagle winter roosting habitat.</p>
WY_BFO_CSU_BGCW	<p>CSU (1) Prior to surface disturbance within Wyoming Game and Fish Department designated big game crucial winter range, a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer’s satisfaction that the function and suitability of crucial big game winter ranges will not be impaired; (2) as mapped by the Wyoming Game and Fish Department; (3) ensuring the function and suitability of crucial big game winter range.</p>
WY_BFO_CSU_C100F	<p>CSU (1) Prior to surface disturbance or disruptive activities near an entrance to a significant cave a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the BLM Authorized Officer’s satisfaction that the action will not destroy, disturb, deface, mar, alter, remove, or harm any significant cave or alter the free movement of any animal or plant life into or out of any significant cave; (2) as mapped by the BLM; (3) protecting significant cave resources (any material or substance occurring naturally in caves, such as animal life, plant life, paleontological deposits, sediments, minerals, speleogens, and speleothems).</p>
WY_BFO_CSU_CLBA	<p>CSU (1) Surface use or occupancy shall not be allowed by oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) on this Federal oil and gas lease to conduct any oil and gas operation, including drilling for, removing, or disposing of oil and/or gas contained in Federal coal lease(s) unless a plan for mitigation of anticipated impacts is developed between the oil and gas and the coal lessees, and the Plan is approved by the BLM Authorized Officer; (2) on areas identified as highly likely to be considered in a Coal Lease By Application as mapped by the US Office of Surface Mining, Wyoming Department of Environmental Quality, US Geological Survey, and/or BLM; (3) protecting the first in time valid existing rights of the coal lessee, the BLM Authorized Officer reserves the right to alter or modify any oil and gas operations on the lands described in this lease ensuring the orderly development of the coal resource by surface and/or</p>

STIPULATION CODE	STIPULATION LANGUAGE
	underground mining methods, coal mine worker safety, and/or coal production rates or recovery of the coal resource. The oil and gas lessee(s), operating rights holder(s), and/or oil and gas operator(s) of this Federal oil and gas lease shall not hold the United States as lessor, coal lessee(s), sub-lessee(s), and/or coal operator(s) liable for any damage or loss of the oil and gas resource, including the venting of coalbed natural gas, caused by coal exploration or mining operations conducted on Federal coal lease.
WY_BFO_CSU_EC	<p>CSU (1) Prior to surface disturbance within Wyoming Game and Fish Department designated elk calving areas a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations.</p> <p>The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer’s satisfaction that the function and suitability of elk calving areas will not be impaired; (2) as mapped by the Wyoming Game and Fish Department; (3) ensuring the function and suitability of elk calving areas.</p>
WY_BFO_CSU_ECWC	<p>CSU (1) Fluid mineral production and byproducts shall be piped out of, and permanent above ground facilities will be located outside of, Wyoming Game and Fish Department designated elk crucial winter range and calving areas unless a mitigation plan (Plan) is submitted by the applicant and approved by the BLM as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer’s satisfaction that the function and suitability of elk crucial winter range and elk calving areas will not be impaired; (2) as mapped by the Wyoming Game and Fish Department; (3) ensuring the function and suitability of elk crucial winter range and elk calving areas.</p>
WY_BFO_CSU_FCR	<p>CSU (1) Surface-disturbing and disruptive activities shall only be approved with adequate mitigation to ensure compliance with the Fortification Creek Resources Management Plan Amendment (BLM 2011) performance standards. Prior to surface disturbance within the Fortification Creek Planning Area a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface- disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate); (2) within the Fortification Creek Planning Area (Map 3- 36); (3) protecting the viability of the Fortification elk herd and facilitating ecosystem reconstruction in the stabilization of disturbed areas.</p>
WY_BFO_CSU_FQM	<p>CSU (1) Prior to surface disturbance within 0.25 mile of naturally occurring water bodies containing native or desirable non-native fish species a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer’s satisfaction that there will not be a local decline in fish abundance or range as a result of the lease operations. Examples of a few of the items to consider are as follows. Spill prevention measures must be used to ensure hydrocarbons and other potentially toxic substances used for lease activities are prevented from</p>

STIPULATION CODE	STIPULATION LANGUAGE
	entering the watercourse. Sediment control measures must be used to ensure increased sediment contributions are avoided; (2) as mapped by the Wyoming Game and Fish Department and/or BLM; (3) protecting native and desirable non-native fish populations and habitat.
WY_BFO_CSU_GSGRH	CSU (1) All applicable surface disturbances (existing or future, and not limited to fluid mineral disturbances) must be restored, as described in the Buffalo Field Office Resource Management Plan, to the approval of the BLM Authorized Officer; (2) Greater Sage-Grouse Core Population Areas and Connectivity Corridors (Priority Habitat) as mapped on the Buffalo Field Office GIS database; (3) to restore functional Greater Sage-Grouse habitat to support core Greater Sage-Grouse populations.
WY_BFO_CSU_H	CSU (1) Prior to surface disturbance within 3 miles of the Pumpkin Buttes, Cantonment Reno, Dull Knife Battle, and Crazy Woman Battle historic properties, contributing and unevaluated segments of the Bozeman Trail, all rock art sites, all rock shelter sites, and all Native American burials, a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator may not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan or approved it with conditions after consultation with the State Historic Preservation Office, applicable Indian tribes, and other interested parties. The Plan must demonstrate to the Authorized Officer’s satisfaction that there will be no adverse effects to National Register of Historic Places eligible or listed historic properties (i.e., the infrastructure will either not be visible or will result in a weak contrast rating); (2) as mapped on the Buffalo Field Office GIS database; (3) ensuring the setting of historic properties.
WY_BFO_CSU_H20500F	CSU (1) Prior to surface disturbance within 500 feet of springs, reservoirs not associated with coal bed natural gas projects, water wells, and perennial streams a site-specific construction, stabilization, and reclamation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the BLM Authorized Officer’s satisfaction how the operator will meet the following performance standards. Storm water and surface runoff will be controlled to minimize erosion (rilling, gullyng, piping, mass wasting) and offsite siltation during construction, use/operations, and reclamation. Offsite areas will be protected from accelerated soil erosion. The original landform and site productivity will be partially restored during interim reclamation and fully restored as a result of final reclamation; (2) as mapped by the US Geological Survey’s National Hydrologic Inventory and/or as determined by a BLM evaluation of the area; (3) ensuring protection of surface waters and associated riparian habitats by meeting the standards outlined in, Chapter 6 of the BLM’s Oil and Gas Gold Book, as revised, and the 2015 Buffalo Field Office Resource Management Plan Record of Decision.
WY_BFO_CSU_PD	CSU (1) Prior to surface disturbance within active prairie dog colonies on BLM- administered surface a special status species occupancy survey must be conducted and a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer’s

STIPULATION CODE	STIPULATION LANGUAGE
	satisfaction that activities with active prairie dog colonies on BLM surface would not adversely impact suitable habitat for special status species dependent upon prairie dog colonies; (2) as mapped or determined on the Buffalo Field Office GIS database or from field evaluation, in coordination with the US Fish and Wildlife Service and Wyoming Game and Fish Department; (3) conserving special status species wildlife and the prairie dog colonies on which they depend.
WY_BFO_CSU_PHMAC	CSU (1) Surface occupancy or use will be restricted. The cumulative value of all applicable surface disturbances, existing or future, must not exceed 5 percent of the Disturbance Density Calculation Tool (DDCT) area, as described in the DDCT manual; (2) as mapped on the Buffalo Field Office GIS database; (3) to protect Greater Sage-Grouse designated Priority Habitat Management Areas (Connectivity only) from habitat fragmentation and loss. This lease does not guarantee the lessee the right to occupy the surface of the lease for the purpose of producing oil and natural gas within Greater Sage-Grouse designated PHMAs (Connectivity only).
WY_BFO_CSU_R500F	CSU (1) Prior to surface disturbance within 500 feet of riparian systems, wetlands, and aquatic habitats a site-specific construction, stabilization, and reclamation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface- disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the BLM Authorized Officer’s satisfaction how the operator will meet the following performance standards. Storm water and surface runoff will be controlled to minimize erosion (rilling, gulying, piping, mass wasting) and offsite siltation during construction, use/operations, and reclamation. Offsite areas will be protected from accelerated soil erosion. The original landform and site productivity will be partially restored during interim reclamation and fully restored as a result of final reclamation; (2) as mapped by the US Geological Survey’s National Hydrologic Inventory and/or as determined by a BLM evaluation of the area; (3) ensuring protection of surface waters and associated riparian habitats by meeting the standards outlined in, Chapter 6 of the BLM’s Oil and Gas Gold Book, as revised, and the 2015 Buffalo Field Office Resource Management Plan Record of Decision.
WY_BFO_CSU_RN	CSU (1) Prior to surface disturbance within US Fish and Wildlife Service recommended spatial buffers of raptor nests a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface- disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer’s satisfaction that nesting raptors will not be disturbed. Nesting raptors will not be agitated or bothered to a degree that causes or is likely to cause physical injury, a decrease in productivity by substantially interfering with normal breeding, feeding, or sheltering behavior, or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior; (2) as mapped on the Buffalo Field Office GIS database or determined by the BLM from field evaluation in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) ensuring raptor productivity.
WY_BFO_CSU_SE	CSU (1) Prior to surface disturbance on soils with a severe erosion hazard rating a site- specific construction, stabilization, and reclamation plan (Plan) must be submitted to the BLM by the applicant as a component of the

STIPULATION CODE	STIPULATION LANGUAGE
	<p>Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the BLM Authorized Officer’s satisfaction how the operator will meet the following performance standards. The disturbed area will be stabilized with no evidence of accelerated erosion features. The disturbed area shall be managed to ensure soil characteristics approximate an appropriate reference site with regard to erosional features to maintain soil productivity and sustainability. Sufficient viable topsoil is maintained for ensuring successful final reclamation. At locations where interim reclamation will be completed, this will be accomplished by respreading all salvaged topsoil over the areas of interim reclamation. The original landform and site productivity will be partially restored during interim reclamation and fully restored as a result of final reclamation; (2) as mapped by the Natural Resources Conservation Service Soil Survey Geographic Database (SSURGO) Order 3 soil survey and/or as determined by a BLM evaluation of the area; (3) ensuring successful reclamation and erosion control on soils with a severe erosion hazard rating in order to meet the standards outlined in Chapter 6 the BLM’s Oil and Gas Gold Book, as revised, and the 2015 Buffalo Field Office Resource Management Plan Record of Decision.</p>
WY_BFO_CSU_Slopes25to50	<p>CSU (1) Prior to surface disturbance on slopes greater than 25% and less than 50% a site-specific construction, stabilization, and reclamation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The Plan must include designs approved and stamped by a licensed engineer. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the BLM Authorized Officer’s satisfaction how the operator will meet the following performance standards. Slope stability is maintained preventing slope failure or mass wasting. The disturbed area will be stabilized with no evidence of accelerated erosion features. The disturbed area shall be managed to ensure soil characteristics approximate an appropriate reference site with regard to erosional features to maintain soil productivity and sustainability. Sufficient viable topsoil is maintained for ensuring successful final reclamation. At locations where interim reclamation will be completed, this will be accomplished by respreading all salvaged topsoil over the areas of interim reclamation. The original landform and site productivity will be partially restored during interim reclamation and fully restored as a result of final reclamation; (2) as mapped by the US Geological Survey (USGS) 1:24,000 scale topographic maps, USGS Digital Elevation Models, and/or as determined by a BLM evaluation of the area; (3) ensuring successful reclamation and erosion control on slopes greater than 25% and less than 50% in order to meet the standards outlined in Chapter 6 of the BLM’s Oil and Gas Gold Book, as revised, and the 2015 Buffalo Field Office Resource Management Plan Record of Decision.</p>
WY_BFO_CSU_SLR	<p>CSU (1) Prior to surface disturbance on limited reclamation potential areas a site- specific construction, stabilization, and reclamation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The Plan must include designs approved and stamped by a licensed engineer. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the BLM</p>

STIPULATION CODE	STIPULATION LANGUAGE
	<p>Authorized Officer’s satisfaction how the operator will meet the following performance standards. The disturbed area will be stabilized with no evidence of accelerated erosion features. The disturbed area shall be managed to ensure soil characteristics approximate an appropriate reference site with regard to erosional features to maintain soil productivity and sustainability. Slope stability is maintained preventing slope failure and erosion. Sufficient viable topsoil is maintained for ensuring successful final reclamation. At locations where interim reclamation will be completed, this will be accomplished by respreading all salvaged topsoil over the areas of interim reclamation. The original landform and site productivity will be partially restored during interim reclamation and fully restored as a result of final reclamation; (2) as mapped by the Natural Resources Conservation Service Soil Survey Geographic Database (SSURGO) Order 3 soil survey and as determined by a BLM evaluation of the area; (3) ensuring successful reclamation and erosion control on limited reclamation potential areas in order to meet the standards outlined in, Chapter 6 of the BLM’s Oil and Gas Gold Book, as revised, and the 2015 Buffalo Field Office Resource Management Plan Record of Decision.</p>
<p>WY_BFO_CSU_SSP</p>	<p>CSU (1) Prior to surface disturbance within Ute ladies’-tresses orchid flowering season survey(s) must be conducted and a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer’s satisfaction that Ute ladies’- tresses orchids will not be harmed and that the habitat on which they depend will be conserved; (2) as mapped or determined by the US Fish and Wildlife Service, Wyoming Natural Diversity Database, the Buffalo Field Office GIS database, or from field evaluation; (3) conserving Ute ladies’-tresses orchids and the habitat on which they depend.</p>
<p>WY_BFO_CSU_SSPF</p>	<p>CSU (1) Prior to surface disturbance within special status plant species habitats, flowering season surveys must be conducted and a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer’s satisfaction that special status plant species will not be harmed and that the habitat on which they depend will be conserved; (2) as mapped or determined by the US Fish and Wildlife Service, Wyoming Natural Diversity Database, the Buffalo Field Office GIS database, or from field evaluation; (3) conserving special status plant species and the habitat on which they depend.</p>
<p>WY_BFO_CSU_SSWLA</p>	<p>CSU (1) Prior to surface disturbance within 1,640 feet (500 meters) of perennial water, vernal pools, playas, and wetlands appropriate surveys must be conducted and a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator may not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan or approved it with conditions. The Plan must demonstrate to the Authorized Officer’s satisfaction that special status amphibian species will not be disturbed to a degree that causes or is likely to cause physical injury, a decrease in productivity by substantially interfering with normal breeding, sheltering, or hibernation behavior, or site abandonment by substantially interfering with normal</p>

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	breeding, sheltering, or hibernation behavior; (2) as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) ensuring production of special status amphibian species breeding, sheltering, and hibernation habitat.
WY_BFO_CSU_SSWLB	CSU (1) Prior to surface disturbance within 1,640 feet (500 meters) of cave entrances, mature forest, and rock outcrops appropriate surveys must be conducted and a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator may not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan or approved it with conditions. The Plan must demonstrate to the Authorized Officer’s satisfaction that special status bat species will not be disturbed to a degree that causes or is likely to cause physical injury, a decrease in productivity by substantially interfering with normal breeding, nursery, roosting, or hibernation behavior, or site abandonment by substantially interfering with normal breeding, nursery, roosting, or hibernation behavior; (2) as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) ensuring protection of special status bat species breeding, nursery, roosting, and hibernation habitat.
WY_BFO_CSU_SSWLH	CSU (1) Prior to surface disturbance within special status species wildlife habitat an occupancy survey must be conducted and a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer’s satisfaction that special status wildlife species will not be harmed (any act which actually kills or injures wildlife including habitat modification or degradation that substantially impairs essential behavioral patterns) and that the habitat on which they depend will be conserved; (2) as mapped or determined by the US Fish and Wildlife Service, Wyoming Game and Fish Department, Wyoming Natural Diversity Database, or BLM from field evaluation; (3) conserving special status species wildlife and the habitat on which they depend (BLM 2008 -6840 manual).
WY_BFO_CSU_SSWLR	CSU (1) Prior to surface disturbance within 1,640 feet (500 meters) of south facing rock outcrops, perennial water, vernal pools, playas, and wetlands appropriate surveys must be conducted and a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator may not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan or approved it with conditions. The Plan must demonstrate to the Authorized Officer’s satisfaction that special status reptile species will not be disturbed to a degree that causes or is likely to cause physical injury, a decrease in productivity by substantially interfering with normal breeding, basking, sheltering, or hibernation behavior, or site abandonment by substantially interfering with normal breeding, basking, sheltering, or hibernation behavior; (2) as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) ensuring production of special status reptile species breeding, basking, sheltering, and hibernation habitat.

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WY_BFO_CSU_STG	CSU (1) Prior to surface disturbance within 0.25 mile of the perimeter of occupied sharp-tailed grouse leks a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer’s satisfaction that the function and suitability of sharp-tailed grouse breeding habitat will not be impaired (result in physical injury, a decrease in productivity by substantially interfering with normal breeding, feeding, or sheltering behavior, or lek abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior); (2) as mapped by the Wyoming Game and Fish Department; (3) ensuring the function and suitability of sharp-tailed grouse breeding habitat.
WY_BFO_CSU_TCP	CSU (1) Prior to surface disturbance within 3 miles of traditional cultural properties a mitigation plan (Plan) must be submitted by the applicant. The Plan must be approved or approved with conditions by the BLM Authorized Officer prior to surface-disturbing activities after consultation with the State Historic Preservation Office, applicable Indian tribes, and other interested parties. The Plan must demonstrate there will be no adverse effects to National Register of Historic Places eligible or listed historic properties (i.e., proposed infrastructure is either not visible or will result in a weak contrast rating); (2) as mapped on the Buffalo Field Office GIS database; (3) ensuring the setting of traditional cultural properties.
WY_BFO_CSU_VRMII	CSU (1) Prior to surface disturbance within Visual Resource Management (VRM) Class 2 areas, a site-specific plan must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the plan (with conditions, as appropriate). The plan must demonstrate to the BLM Authorized Officer’s satisfaction how the operator will meet the following performance standards. A visual contrast rating must demonstrate that VRM Class 2 objectives will be met. Where required by the BLM Authorized Officer, a visual simulation must be prepared and must demonstrate that VRM Class 2 objectives will be met through practices such as siting of permanent facilities. Where present and feasible, existing surface disturbances shall be utilized. New surface disturbances shall be minimized to the extent practicable. All permanent above-ground facilities (such as production tanks or other production facilities) not having specific coloration requirements for safety must be painted or designed using a BLM- approved color; (2) as mapped on the Buffalo Field Office GIS database; (3) protecting VRM Class 2 areas.
WY_BFO_CSU_WHSRMA	CSU (1) Prior to surface disturbance within Special Recreation Management Areas (SRMAs) available for leasing (Weston Hills) a mitigation plan (Plan) must be submitted to the BLM by the applicant as a component of the Application for Permit to Drill (BLM Form 3160-3) or Sundry Notice (BLM Form 3160-5) – Surface Use Plan of Operations. The operator shall not initiate surface-disturbing activities unless the BLM Authorized Officer has approved the Plan (with conditions, as appropriate). The Plan must demonstrate to the Authorized Officer’s satisfaction that the proposed action is consistent with the prescribed management for the SRMA; (2) as mapped or determined by BLM; (3) ensuring the recreational opportunities and setting of the SRMA.
WY_BFO_NSO_BEGE	NSO (1) Within 0.5 miles from the edge of consistently used bald or golden eagle winter roosts and Clear Creek, Crazy Woman Creek, Piney Creek, Powder River, and Tongue River, consistently used riparian corridors, as

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	mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (2) protecting wintering bald and golden eagles.
WY_BFO_NSO_BEN	NSO (1) Within 0.5 mile of bald eagle nests as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (2) ensuring productivity of bald eagles.
WY_BFO_NSO_BGHMA	NSO (1) Within Wyoming Game and Fish Department Big Game Habitat Management Areas (Ed O. Taylor, Kerns, Bud Love, and Amsden Creek) as mapped by the Wyoming Game and Fish Department; (2) ensuring the function and suitability of Wyoming Game and Fish Department Big Game Habitat Management Areas.
WY_BFO_NSO_H	NSO (1) Within the Pumpkin Buttes, Cantonment Reno, Dull Knife Battle, and Crazy Woman Battle historic properties, contributing and unevaluated segments of the Bozeman Trail, all rock art sites, all rock shelter sites, all Native American burials; as mapped on the Buffalo Field Office GIS database; (2) protecting historic properties.
WY_BFO_NSO_HIP	NSO (1) No surface occupancy or use is allowed on lands containing paleontological resources of high quality or importance as mapped on the Buffalo Field Office GIS database; (2) protecting paleontological resources of high quality or importance.
WY_BFO_NSO_PBACEC	NSO (1) Within the Pumpkin Buttes Area of Critical Environmental Concern as mapped or determined by BLM; (2) protecting the relevant and important values.
WY_BFO_NSO_Slopes50	NSO (1) On slopes greater than 50% as mapped by the US Geological Survey 1:24,000 scale topographic maps, US Geological Survey Digital Elevation Models, and/or as determined by a BLM evaluation of the area; (2) preventing mass slope failure and accelerated erosion.
WY_BFO_NSO_SSF	NSO (1) Within 0.25 mile of any waters containing special status fish species as mapped on the Buffalo Field Office GIS database or from field evaluation, in consultation with the Wyoming Game and Fish Department; (2) protecting special status fish populations and habitat.
WY_BFO_NSO_SSP	NSO (1) Within special status species plant populations as mapped on the Buffalo Field Office GIS database, or determined by BLM from field evaluation, in coordination with the Wyoming Natural Diversity Database and/or US Fish and Wildlife Service; (2) protecting special status species plant populations.
WY_BFO_NSO_SSRN	NSO (1) Within a species specific spatial buffer of special status species raptor nests using US Fish and Wildlife Service Wyoming Ecological Service's recommendations (Appendix Q (p. 633) or www.fws.gov/wyominges/Pages/Species/Species_SpeciesConcern/Raptors.html) as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (2) protecting nest sites of special status raptors.
WY_BFO_NSO_TCP	NSO (1) On lands containing traditional cultural properties as mapped on the Buffalo Field Office GIS database; (2) protecting traditional cultural properties.
WY_BFO_TLS_BEN	TLS (1) Surface-disturbing and disruptive activities are prohibited or restricted from Feb 1 to Aug 15 within 1.0 mile of active bald eagle nests; (2) as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) ensuring productivity of bald eagles.

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WY_BFO_TLS_BGCWEC	TLS (1) Surface-disturbing and disruptive activities are prohibited or restricted from Nov 15 to Apr 30 within big-game crucial winter range, or from May 1 to Jun 15 within elk calving areas (Wyoming Game and Fish Department 2009); (2) as mapped by the Wyoming Game and Fish Department and evaluated by the BLM; (3) ensuring the function and suitability of crucial big game winter ranges.
WY_BFO_TLS_EC	TLS (1) Surface-disturbing and disruptive activities are prohibited or restricted from May 1 to Jun 15 within elk calving areas (Wyoming Game and Fish Department 2009); (2) as mapped by the Wyoming Game and Fish Department and evaluated by the BLM; (3) ensuring the function and suitability of elk calving areas.
WY_BFO_TLS_EWR	TLS (1) Surface-disturbing and disruptive activities are prohibited or restricted from Nov 1 to Apr 1 within 1.0 mile from the edge of consistently used eagle winter roosts and the following consistently used riparian corridors: Clear Creek, Crazy Woman Creek, Piney Creek, Powder River, and Tongue River; (2) as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) protecting roosting eagles.
WY_BFO_TLS_NSSRN	TLS (1) Surface-disturbing and disruptive activities are prohibited or restricted within the US Fish and Wildlife Service Wyoming Ecological Service's recommended spatial buffers and dates of active non-special status species raptor nests. (Appendix Q (p. 633) or www.fws.gov/wyominges/Pages/Species/Species_SpeciesConcern/Raptors.html); (2) as mapped on the Buffalo Field Office GIS database or determined by BLM from field evaluation in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) ensuring raptor nest productivity.
WY_BFO_TLS_PHMAC	TLS (1) Mar 15 to Jun 30; (2) as mapped on the Buffalo Field Office GIS database; (3) no surface use to seasonally protect Greater Sage-Grouse breeding, nesting and early brood-rearing habitats (independent of habitat suitability) inside Priority Habitat Management Areas (Connectivity only), within 4 miles of an occupied lek.
WY_BFO_TLS_PHMAL	TLS (1) Mar 15 to Jun 30; (2) as mapped on the Buffalo Field Office GIS database; (3) no surface use to seasonally protect Greater Sage-Grouse breeding, nesting and early brood-rearing habitats (independent of habitat suitability) inside designated Priority Habitat Management Areas (Core only). Where credible data support different timeframes for this restriction, dates may be expanded by 14 days prior or subsequent to the above dates.
WY_BFO_TLS_PHMAWCA	TLS (1) Dec 1 to Mar 14; (2) as mapped on the Buffalo Field Office GIS database; (3) to seasonally protect Greater Sage-Grouse winter concentration areas in designated Priority Habitat Management Areas (Core and Connectivity), and outside designated PHMAs (Core and Connectivity) when supporting wintering Greater Sage-Grouse that attend leks within designated PHMAs (Core only).
WY_BFO_TLS_SSRN	TLS (1) Surface-disturbing and disruptive activities are prohibited or restricted within US Fish and Wildlife Service recommended spatial buffers and dates (Appendix Q (p. 633) or www.fws.gov/wyominges/Pages/Species/Species_SpeciesConcern/Raptors.html) of active raptor nests of special status species; (2) as mapped on the Buffalo Field Office GIS database or determined by field evaluation, in coordination with the Wyoming Game and Fish Department and/or US Fish and Wildlife Service; (3) ensuring productivity of nesting special status raptors.

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WY_BFO_TLS_STG	TLS (1) Surface-disturbing and disruptive activities are prohibited or restricted from Apr 1 to Jul 15 (Wyoming Game and Fish Department 2009) within 2 miles of the perimeter of occupied sharp-tailed grouse leks; (2) as mapped by the Wyoming Game and Fish Department and evaluated by the BLM; (3) ensuring the function and suitability of sharp-tailed grouse nesting habitat.
WY_LFO_CSU_BRMLP2024	CSU (1) Surface occupancy or use will be restricted; (2) as mapped on the Lander Field Office GIS database; (3) protecting unique plant communities, cultural sites, viewshed, geologic resources, wild horse migration routes, and riparian-wetland resources of the Beaver Rim Master Leasing Plan analysis area.
WY_LFO_CSU_LRPS1013	CSU (1) Surface occupancy or use will be restricted; (2) as mapped on the Lander Field Office GIS database; (3) protecting limited reclamation potential soils.
WY_LFO_CSU_PYFC5058	CSU (1) Surface use or occupancy is restricted; (2) as mapped on the Lander Field Office GIS database; (3) protecting fossil resources within designated “very high” or “high” potential fossil yield classification areas.
WY_LFO_CSU_RHTEH5018	CSU (1) Surface use or occupancy will be restricted within a 2-mile buffer of Regional Historic Trails and Early Highways; (2) as mapped on the Lander Field Office GIS database; (3) protecting the Regional Historic Trails and Early Highways and their settings.
WY_LFO_CSU_S15TO24P1014	CSU (1) Surface occupancy or use will be restricted; (2) as mapped on the Lander Field Office GIS database; (3) protecting areas containing slopes between 15 and 24 percent.
WY_LFO_CSU_SR6124	CSU (1) Surface use or occupancy is restricted within the Sweetwater Rocks viewshed; (2) as mapped on the Lander Field Office GIS database; (3) protecting the Sweetwater Rocks periphery.
WY_LFO_CSU_VRM5066	CSU (1) Surface occupancy or use is restricted; (2) as mapped on the Lander Field Office GIS database; (3) protecting VRM Class I and II areas.
WY_LFO_CSU1048	CSU (1) Surface occupancy and use will be restricted; (2) as mapped on the Lander field Office GIS database; (3) protecting 100-year floodplains and riparian-wetland areas.
WY_LFO_CSU2024	CSU (1) Surface occupancy and use will be restricted; (2) as mapped on the Lander Field Office GIS database; (3) protecting 100-year floodplains within the Beaver Rim Master Leasing Plan analysis area.
WY_LFO_CSU5025	CSU (1) Surface use or occupancy will be restricted; (2) as mapped on the Lander Field Office GIS database; (3) protecting the Cedar Ridge Traditional Cultural Property periphery.
WY_LFO_NSO_ACEC7059	NSO (1) As mapped on the Lander Field Office GIS database; (2) protecting the relevant and important Area of Critical Environmental Concern values.
WY_LFO_NSO_BRH4095	NSO (1) Within 0.25-mile of identified bat maternity roosts and hibernation sites as mapped on the Lander Field Office GIS database; (2) protecting bat maternity roosts and hibernation sites.
WY_LFO_NSO_BRMLP2024	NSO (1) As mapped on the Lander Field Office GIS database; (2) protecting unique plant communities, cultural sites, viewshed, and geologic resources in the Beaver Rim Master Leasing Plan area.
WY_LFO_NSO_CG5034	NSO (1) as mapped on the Lander Field Office GIS database; (2) protecting the Castle Gardens cultural site and periphery.
WY_LFO_NSO_HTAC4045	NSO (1) As mapped on the Lander Field Office GIS database; (2) protecting wildlife, cultural resources, viewshed, and/or recreational use(s) in the Hudson to Atlantic City area.
WY_LFO_NSO_NTMC7002	NSO (1) As mapped on the Lander Field Office GIS database; (2) protecting Congressionally Designated Trails and their settings.
WY_LFO_NSO_OPR4088	NSO (1) Within 200 feet of occupied pygmy rabbit habitat, as mapped in the Lander Field Office GIS database; (2) protecting pygmy rabbit habitat.

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WY_LFO_NSO_PSW4031	NSO (1) Within 500 feet of perennial surface waters, riparian-wetland areas, and/or playas, as mapped on the Lander Field Office GIS database; (2) protecting perennial surface waters, riparian-wetland areas, and/or playas outside of Designated Development Areas.
WY_LFO_NSO_PSWDDA4031	NSO (1) Within 500 feet of perennial surface waters, riparian-wetland areas, and/or playas, as mapped on the Lander Field Office GIS database; (2) protecting perennial surface waters, riparian-wetland areas, and/or playas within Designated Development Areas.
WY_LFO_NSO_REC6086	NSO (1) As mapped on the Lander Field Office GIS database; (2) protecting developed recreation sites.
WY_LFO_NSO_SG25P1014	NSO (1) As mapped on the Lander Field Office GIS database; (2) protecting areas containing slopes greater than 25 percent.
WY_LFO_NSO_YERMO4084	NSO (1) As mapped on the Lander Field Office GIS database; (2) protecting desert yellowhead population management areas.
WY_LFO_NSO1045	NSO (1) As mapped on the Lander Field Office GIS database; (2) protecting identified sole source aquifers.
WY_LFO_NSO2024	NSO (1) As mapped on the Lander Field Office GIS database; (2) protecting 100-year floodplains within the Beaver Rim Master Leasing Plan analysis area.
WY_LFO_TLS_BGCW4061	Surface-disturbing and disruptive activities are prohibited in big game crucial winter range areas (1) as mapped on the Lander Field Office database, (2) from November 15 to April 30, and (3) to protect big game parturition areas.
WY_LFO_TLS_MPN4094	Surface-disturbing and disruptive activities are restricted or prohibited within 0.25 mile of identified mountain plover habitat (1) as mapped on the Lander GIS database, (2) from April 10 to July 10, and (3) for the protection of mountain plover nesting habitat.
WY_LFO_TLS_PHMAWCA	TLS (1) Dec 1 to Mar 14; (2) as mapped on the Lander Field Office GIS database; (3) seasonally protecting Greater Sage-Grouse winter concentration areas.
WY_LFO_TLS_RN4071	TLS (1) Within 1 mile of bald eagle and ferruginous hawk nests and 0.75-mile of all other active raptor nests during the following time periods, Apr 1 to Aug 31 for northern goshawk, Apr 1 to Sep 15 for burrowing owl, Feb 1 to Aug 15 for bald and/or golden eagles, and Feb 1 to Jul 31 for all other raptors; (2) as mapped on the Lander Field Office GIS database; (3) protecting active raptor nests.
WY_NFO_CSU_PHMAC	CSU (1) Surface occupancy or use will be restricted. The cumulative value of all applicable surface disturbances, existing or future, must not exceed 5 percent of the Disturbance Density Calculation Tool (DDCT) area, as described in the DDCT manual; (2) as mapped on the Newcastle Field Office GIS database; (3) to protect Greater Sage-Grouse designated Priority Habitat Management Areas (Connectivity only) from habitat fragmentation and loss. This lease does not guarantee the lessee the right to occupy the surface of the lease for the purpose of producing oil and natural gas within Greater Sage-Grouse designated PHMAs (Connectivity only). The surface occupancy restriction criteria identified in this stipulation may preclude surface occupancy and may be beyond the ability of the lessee to meet due to existing surface disturbance on Federal, State, or private lands within designated PHMAs (Connectivity only) or surface disturbance created by other land users. The BLM may require the lessee or operator to enter into a unit agreement or drilling easement to facilitate the equitable development of this and surrounding leases.
WY_NFO_TLS_PHMAC	TLS (1) Mar 15 to Jun 30; (2) as mapped on the Newcastle Field Office GIS database; (3) no surface use to seasonally protect Greater Sage-Grouse breeding, nesting and early brood-rearing habitats (independent of habitat

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	suitability) inside Priority Habitat Management Areas (Connectivity only), within 4 miles of an occupied lek.
WY_SW_CSU_PHMA	CSU (1) Surface occupancy or use will be restricted to no more than an average of one disturbance location per 640 acres using the Disturbance Density Calculation Tool (DDCT), and the cumulative value of all applicable surface disturbances, existing or future, must not exceed 5 percent of the DDCT area, as described in the DDCT manual; (2) as mapped on the applicable Field Office GIS database; (3) to protect Greater Sage-Grouse designated Priority Habitat Management Areas (Core only) from habitat fragmentation and loss. This lease does not guarantee the lessee the right to occupy the surface of the lease for the purpose of producing oil and natural gas within Greater Sage-Grouse designated PHMAs (Core only). The surface occupancy restriction criteria identified in this stipulation may preclude surface occupancy and may be beyond the ability of the lessee to meet due to existing surface disturbance on Federal, State, or private lands within designated PHMAs (Core only) or surface disturbance created by other land users. The BLM may require the lessee or operator to enter into a unit agreement or drilling easement to facilitate the equitable development of this and surrounding leases.
WY_SW_NSO_GHMAL	NSO (1) As mapped on the applicable Field Office GIS database; (2) to protect occupied Greater Sage-Grouse leks and associated seasonal habitat, life-history, or behavioral needs of Greater Sage-Grouse in proximity to leks from habitat fragmentation and loss, and protect Greater Sage-Grouse populations from disturbance within a 0.25-mile radius of the perimeter of occupied Greater Sage- Grouse leks outside designated Priority Habitat Management Areas (Core and Connectivity).
WY_SW_NSO_PHMAL	NSO (1) As mapped on the applicable Field Office GIS database; (2) to protect occupied Greater Sage-Grouse leks and associated seasonal habitat, life-history, or behavioral needs of Greater Sage-Grouse in proximity to leks from habitat fragmentation and loss, and protect Greater Sage-Grouse populations from disturbance within a 0.6-mile radius of the perimeter of occupied Greater Sage- Grouse leks inside designated Priority Habitat Management Areas (Core and Connectivity).
WY_SW_TLS_GHMAL	TLS (1) Mar 15 to Jun 30; (2) as mapped on the applicable Field Office GIS database; (3) no surface use to seasonally protect Greater Sage-Grouse breeding, nesting and early brood-rearing habitats outside designated Priority Habitat Management Areas (Core and Connectivity), within 2 miles of an occupied lek.
WY_SW_TLS_PHMAL	TLS (1) Mar 15 to Jun 30; (2) as mapped on the applicable Field Office GIS database; (3) no surface use to seasonally protect Greater Sage-Grouse breeding, nesting and early brood-rearing habitats (independent of habitat suitability) inside designated Priority Habitat Management Areas (Core only).
WY_SW_TLS_PHMAWCA	TLS (1) Dec 1 to Mar 14; (2) as mapped on the applicable Field Office GIS database; (3) no surface use to seasonally protect Greater Sage-Grouse winter concentration areas in designated Priority Habitat Management Areas (Core only), and outside designated PHMAs (Core only) when supporting wintering Greater Sage-Grouse that attend leks within designated PHMAs (Core only).

Lease Notices and Stipulations

Lease Notice No. 1 – Reasonable Measures to Minimize Adverse Impacts to Resources (applies to all parcels)
Under Regulation 43 CFR 3101.12 and terms of the lease (BLM Form 3100-11), the authorized officer may require reasonable measures to minimize adverse impacts to other resource values, land uses, and users not addressed in lease stipulations at the time operations are proposed. Such reasonable measures may include, but are not limited to,

modification of siting or design of facilities, timing of operations, and specification of interim and final reclamation measures, which may require relocating proposed operations up to 200 meters, but not off the leasehold, and prohibiting surface disturbance activities for up to 60 days.

The lands within this lease may include areas not specifically addressed by lease stipulations that may contain special values, may be needed for special purposes, or may require special attention to prevent damage to surface and/or other resources. Possible special areas are identified below. Any surface use or occupancy within such special areas will be strictly controlled or, if absolutely necessary, prohibited. Appropriate modifications to imposed restrictions will be made for the maintenance and operation of producing wells.

1. Slopes in excess of 25 percent.
2. Within 500 feet of surface water and/or riparian areas.
3. Construction with frozen material or during periods when the soil material is saturated or when watershed damage is likely to occur.
4. Within 500 feet of Interstate highways and 200 feet of other existing rights-of-way (i.e., U.S. and State highways, roads, railroads, pipelines, powerlines).
5. Within 1/4 mile of occupied dwellings.
6. Material sites

GUIDANCE: The intent of this notice is to inform interested parties (potential lessees, permittees, operators) that when one or more of the above conditions exist, surface disturbing activities will be prohibited unless or until the permittee or the designated representative and the surface management agency (SMA) arrive at an acceptable plan for mitigation of anticipated impacts. This negotiation will occur prior to development and become a condition for approval when authorizing the action. Specific threshold criteria (e.g., 500 feet from water) have been established based upon the best information available. However, geographical areas and time periods of concern must be delineated at the field level (i.e., "surface water and/or riparian areas" may include both intermittent and ephemeral water sources or may be limited to perennial surface water). The referenced oil and gas leases on these lands are hereby made subject to the stipulation that the exploration or drilling activities will not interfere materially with the use of the area as a materials site/free use permit. At the time operations on the above lands are commenced, notification will be made to the appropriate agency. The name of the appropriate agency may be obtained from the proper BLM Field Office.

Lease Notice No. 2 – National Historic Trails (applies to all parcels)

BACKGROUND: The Bureau of Land Management (BLM), by including National Historic Trails within its National Landscape Conservation System, has recognized these trails as national treasures. Our responsibility is to review our strategy for management, protection, and preservation of these trails. The National Historic Trails in Wyoming, which include the Oregon, California, Mormon Pioneer, and Pony Express Trails, as well as the Nez Perce Trail, were designated by Congress through the National Trails System Act (P.L. 90-543; 16 U.S.C. 1241-1251) as amended through P.L. 106-509 dated November 13, 2000. Protection of the National Historic Trails is normally considered under the National Historic Preservation Act (P.L. 89-665; 16 U.S.C. 470 et seq.) as amended through 1992 and the National Trails System Act. Additionally, Executive Order 13195, "Trails for America in the 21st Century," signed January 18, 2001, states in Section 1: "Federal agencies will...protect, connect, promote, and assist trails of all types throughout the United States. This will be accomplished by: (b) Protecting the trail corridors associated with national scenic trails and the high priority potential sites and segments of national historic trails to the degrees necessary to ensure that the values for which each trail was established remain intact." Therefore, the BLM will be considering all impacts and intrusions to the National Historic Trails, their associated historic landscapes, and all associated features, such as trail traces, grave sites, historic encampments, inscriptions, natural features frequently commented on by emigrants in journals, letters and diaries, or any other feature contributing to the historic significance of the trails. Additional National Historic Trails will likely be designated amending the National Trails System Act. When these amendments occur, this notice will apply to those newly designated National Historic Trails as well.

STRATEGY: The BLM will proceed in this objective by conducting a viewshed analysis on either side of the designated centerline of the National Historic Trails in Wyoming, except, at this time, for the Nez Perce Trail, for the purpose of identifying and evaluating potential impacts to the trails, their associated historic landscapes, and their associated historic features. Subject to the viewshed analysis and archaeological inventory, reasonable mitigation

measures may be applied. These may include, but are not limited to, modification of siting or design of facilities to camouflage or otherwise hide the proposed operations within the viewshed. Additionally, specification of interim and final reclamation measures may require relocating the proposed operations within the leasehold.

Surface disturbing activities will be analyzed in accordance with the National Environmental Policy Act of 1969 (P.L. 91- 190; 42 U.S.C. 4321-4347) as amended through P.L. 94-52, July 3, 1975 and P.L. 94-83, August 9, 1975, and the National Historic Preservation Act, supra, to determine if any design, siting, timing, or reclamation requirements are necessary. This strategy is necessary until the BLM determines that, based on the results of the completed viewshed analysis and archaeological inventory, the existing land use plans (Resource Management Plans) have to be amended. The use of this lease notice is a pre-decisional action, necessary until final decisions regarding surface disturbing restrictions are made. Final decisions regarding surface disturbing restrictions will take place with full public disclosure and public involvement over the next several years if BLM determines that it is necessary to amend existing land use plans.

GUIDANCE: The intent of this notice is to inform interested parties (potential lessees, permittees, operators) that when any oil and gas lease contains remnants of National Historic Trails, or is located within the viewshed of a National Historic Trails' designated centerline, surface disturbing activities will require the lessee, permittee, operator or, their designated representative, and the surface management agency (SMA) to arrive at an acceptable plan for mitigation of anticipated impacts. This negotiation will occur prior to development and become a condition for approval when authorizing the action.

Lease Notice No. 3 – Greater Sage-Grouse Habitat (applies to all parcels)

Greater Sage-Grouse Habitat: The lease may in part, or in total, contain important Greater sage-grouse habitats as identified by the BLM, either currently or prospectively. The operator may be required to implement specific measures to reduce impacts of oil and gas operations on the Greater sage-grouse populations and habitat quality. Such measures shall be developed during the Application for Permit to Drill (APD) on-site and environmental review process and will be consistent with the lease rights granted.

Lease Notice 1041 – Water Monitoring Plans

Lease Notice. Require water monitoring plans for new activities resulting in surface discharges of water to track changes in receiving channels and to minimize adverse impacts to watershed health. If adverse impacts to receiving channels or watershed health occur, require development and implementation of water management plans which include reclamation strategies and mitigation to address impacts. Avoid BLM-authorized activities and infrastructure such as unlined impoundment ponds/pits, reserve pits, and evaporation ponds that could result in the contamination of sensitive water resources, including Source Water Protection Areas identified in Wellhead or Source Water Protection Plans approved local governing bodies and “High” and “Moderately High” sensitivity aquifer systems identified through the use of the Wyoming Groundwater Vulnerability Assessment Handbook or similar document as updated over time to the maximum extent possible. Where such activities or infrastructure cannot be avoided, apply mitigation to reduce potential impacts on a case-by-case basis.

WY Std Special Lease Notice II – Big Game Migration

Special Lease Notice: This parcel is located wholly or partially within a big game migration corridor designated by the State of Wyoming. The lessee or their designated operator will be required to work with the BLM and the State of Wyoming to take reasonable measures (see 43 CFR 3101.12) to maintain big game migration corridor functionality pursuant to State of Wyoming Executive Order 2020-1. The BLM will encourage the use of Master Development Plans for operations proposed on this lease parcel in accordance with 43 CFR 3171.

Special Lease Notice – Unplugged Well Bore

Unplugged wellbore(s) and/or other facilities are located on this parcel. For more information, please contact a Petroleum Engineer at the [insert office name] Field Office at (307) [insert phone number].

HQ-CR-1 – Cultural Resource Protection (applies to all parcels)

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, Executive Order 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 (e.g.,

State Historic Preservation Officer (SHPO) and tribal consultation) 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.

HQ-MLA-1 – Notice to Lessee Concerning Mineral Leasing Act Section 2(a)(2)(A)

Provisions of the Mineral Leasing Act (MLA) of 1920, as amended by the Federal Coal Leasing Amendments Act of 1976, affect an entity's qualifications to obtain an oil and gas lease. Section 2(a)(2)(A) of the MLA, 30 U.S.C. 201(a)(2)(A), requires that any entity that holds and has held a Federal Coal Lease for 10 years beginning on or after August 4, 1976, and that is not producing coal in commercial quantities from each such lease cannot qualify for the issuance of any other lease granted under the MLA. 43 CFR 3472 explains coal lessee compliance with Section 2(a)(2)(A).

In accordance with the terms of this oil and gas lease with respect to compliance by the initial lessee with qualifications concerning Federal coal lease holdings, all assignees and transferees are hereby notified that this oil and gas lease is subject to cancellation if: (1) the initial lessee as assignor or as transferor has falsely certified compliance with Section 2(a)(2)(A) because of a denial or disapproval by a State Office of a pending coal action, i.e., arms-length assignment, relinquishment, or logical mining unit; (2) the initial lessee as assignor or as transferor is no longer in compliance with Section 2(a)(2)(A); or (3) the assignee or transferee does not qualify as a bona fide purchaser and, thus, has no rights to bona fide purchaser protection in the event of cancellation of this lease due to noncompliance with Section 2(a)(2)(A).

The lease case file, as well as in other Bureau of Land Management (BLM) records available through the State Office issuing this lease, contains information regarding assignor or transferor compliance with Section 2(a)(2)(A).

HQ-TES-1 – Endangered Species Act Section 7 Consultation Stipulation (applies to all parcels)

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. The 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. The 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.

Lease Stipulation No. 3 – Multiple Mineral Development (applies to all parcels)

Operations will not be approved which, in the opinion of the authorized officer, would unreasonably interfere with the orderly development and/or production from a valid existing mineral lease issued prior to this one for the same lands.

5.3 Hydraulic Fracturing White Paper (July 5, 2013, updated 2018)

BACKGROUND

Hydraulic fracturing (HF) is a well stimulation process used to maximize the extraction of underground resources – oil, natural gas and geothermal energy. The HF process includes the acquisition of water/mixing of chemicals, production zone fracturing, and HF flowback disposal.

In the United States, HF has been used since the 1940's. Early on, the HF process utilized pressures that are of a much smaller magnitude than those used today.

The HF process involves the injection of a fracturing fluid and propping agent into the hydrocarbon bearing formation under sufficient pressure to further open existing fractures and/or create new fractures. This allows the hydrocarbons to more readily flow into the wellbore. HF has gained interest recently as hydrocarbons previously trapped in low permeability tight sand and shale formations are now technically and economically recoverable. As a result, oil and gas production has increased significantly in the United States. The state of Wyoming classifies all gas production zones as Class 5 groundwater zones; this means these zones can be highly impacted by oil and gas activities and are exempt from regulation under the Clean Water Act. However, operations within these zones cannot cause other zones to lose their use classification.

Prior to the development of hydrocarbon bearing tight gas and shale formations, domestic production of conventional resources had been declining. In response to this decline, the federal government in the 1970's through 1992, passed tax credits to encourage the development of unconventional resources. It was during this time that the HF process was further advanced to include the high-pressure multi-stage frac jobs used today.

Generally, HF can be described as follows:

1. Water, proppant, and chemical additives are pumped at extremely high pressures down the wellbore.
2. The fracturing fluid is pumped through perforated sections of the wellbore and into the surrounding formation, creating fractures in the rock. The proppant holds the fractures open during well production.
3. Company personnel continuously monitor and gauge pressures, fluids and proppants, studying how the sand reacts when it hits the bottom of the wellbore, slowly increasing the density of sand to water as the frac progresses.
4. This process may be repeated multiple times, in "stages" to reach maximum areas of the formation(s). The wellbore is temporarily plugged between each stage to maintain the highest fluid pressure possible and get maximum fracturing results in the rock.
5. The plugs are drilled or removed from the wellbore and the well is tested for results.
6. The pressure is reduced and the fracturing fluids are returned up the wellbore for disposal or treatment and re-use, leaving the sand in place to prop open the fractures and allow the oil/gas to flow.

OPERATIONAL ISSUES

Wells that undergo HF may be drilled vertically, horizontally, or directionally and the resultant fractures induced by HF can be vertical, horizontal, or both. Wells in Wyoming (WY) may extend to depths greater than 20,000 feet or less than 1,000 feet, and horizontal sections of a well may extend several thousand feet from the production pad on the surface².

The total volume of fracturing fluids is generally 95-99% water. The amount of water needed to fracture a well in WY depends on the geologic basin, the formation, and depth and type of well (vertical, horizontal, directional), and the proposed completion process.

In general, approximately 50,000 to 300,000 gallons may be used to fracture shallow coalbed methane wells in the Powder River Basin, while approximately 800,000 to 2 million gallons may be used to fracture deep tight sand gas wells in southwestern WY. In the Niobrara oil play, approximately 250,000 gallons may be used to fracture a

² See Kemmerer RMP (2010), Pinedale RMP (2008), Green River RMP (1997), Rock Springs RMP Revision, and Rawlins RMP (2008) RFD and/or Mineral Occurrence Reports for specific information on current and projected oil and gas development.

vertical well, while up to 5 million gallons may be used to fracture a horizontal well.

Proppant, consisting of synthetic or natural silica sand, may be used in quantities of a few hundred tons for a vertical well to a few thousand tons for a horizontal well.

Drilling muds, drilling fluids, water, proppant and hydraulic fracturing fluids are stored in onsite tanks or lined pits during the drilling and/or completion process. Equipment transport and setup can take several days, and the actual HF and flowback process can occur in a few days up to a few weeks. For oil wells, the flowback fluid from the HF operations is treated in an oil-water separator before it is stored in a lined pit or tank located on the surface. Where gas wells are flowed back using a “green completion process” fluids are run through a multi-phase separator, which are then piped directly to enclosed tanks or to a production unit.

Gas emissions associated with the HF process are captured when the operator utilizes a green completion process. Where a green completion process is not utilized, gas associated with the well may be vented and/or flared until “saleable quality” product is obtained in accordance with federal and state rules and regulations. The total volume of emissions from the equipment used (trucks, engines) will vary based on the pressures needed to fracture the well, and the number of zones to be fractured. Emissions associated with a project, and HF if proposed, will be analyzed through a site specific NEPA document to ensure that the operation will not cause a violation of the Clean Air Act.

Under either completion process, wastewaters from HF may be disposed in several ways. For example, the flowback fluids may be stored in tanks pending reuse; the resultant waste may be re-injected using a permitted injection well, or the waste may be hauled to a licensed facility for treatment, disposal and/or reuse.

Disposal of the waste stream following establishment of “sale-quality” product, would be handled in accordance with 43 CFR § 3177 regulations and other state/federal rules and regulations.

FRACTURING FLUIDS

As indicated above, the fluid used in the HF process is approximately 95 to 99 percent water and a small percentage of special-purpose chemical additives^{3,4} and proppant. There is a broad array of chemicals that can be used as additives in a fracture treatment including, but not limited to, hydrochloric acid, anti-bacterial agents, corrosion inhibitors, gelling agents (polymers), surfactants, and scale inhibitors. The 1 to 5 percent of chemical additives translates to a minimum of 5,000 gallons of chemicals for every 1.5 million gallons of water used to fracture a well (Paschke, Dr. Suzanne. USGS, Denver, Colorado. September 2011). Water used in the HF process is generally acquired from surface water or groundwater in the local area.

RE-FRACTURING

Re-fracturing of wells (RHF) may be performed after a period of time to restore declining production rates. RHF success can be attributed to enlarging and reorienting existing fractures while restoring conductivity due to proppant degradation and fines plugging.

Prior to RHF, the wellbore may be cleaned out. Cleaning out the wellbore may recover over 50% of the initial frac sand. Once cleaned, the process of RHF is the same as the initial HF. The need for RHF cannot be predicted.

WATER AVAILABILITY AND CONSUMPTION ESTIMATES

The Wyoming Framework Water Plan, A Summary, (Wyoming Water Development Commission, October 2007), indicates that approximately 15 million acre-feet per year of water becomes either surface water or groundwater and is available for use. This estimate includes water that flows into the state and the precipitation that runs off as stream flow or infiltrates as groundwater; it does not include volumes lost to evapotranspiration.

Water flowing out of WY is estimated to be 13,678,200 acre-feet per year. Wyoming’s share of this supply under existing water compacts is estimated to be 3,313,500 acre-feet per year; approximately 10,364,700 acre-feet flows downstream out of the state.

³FracFocus Chemical Registry. Hydraulic Fracturing Water Usage

⁴Chesapeake Energy. 2012. Hydraulic Fracturing Fact Sheet. http://www.chk.com/Media/Educational-Library/Fact-Sheets/Corporate/Hydraulic_Fracturing_Fact_Sheet.pdf (Last accessed March 1, 2012)

The industrial water use sector includes electric power generation, coal mining, conventional oil and gas production, uranium mining, trona mining and soda ash production, bentonite mining, gypsum mining, coalbed methane (CBM) production, manufacturing of aggregate, cement, and concrete, and road and bridge construction.

Total current industrial surface water use for Wyoming is estimated to be 125,000 acre- feet per year. Total current industrial groundwater water use is estimated to be 246,000 acre-feet per year.

According to the state water plan, it appears likely that any new water-intensive industrial developments in the state over the next 30 years will fall into the electric power generation and/or chemical products categories. The other two intensive water use industries, primary metals and paper producers, tend to locate near the source of their largest process inputs – metals and wood respectively. The total projected industrial use under the Mid Scenario is 331,000 acre-feet per year. The Mid-Scenario is a middle of the road estimate versus the projected low or high scenarios.

Water needs for future fracturing jobs were estimated for this discussion paper using the current Reasonable Foreseeable Development (RFD) scenario numbers taken from each of the nine WY RMPs and multiplied by the maximum volume of water necessary based on information located at fracfocus.org. The table is provided, below. Based on a statewide RFD of 25,478 non-CBM wells and 18,299 CBM wells, the maximum projected water needs for HF is 401,319 acre-feet of water. This number is an estimate based upon maximum projected water needs per HF job, and assumes that 100% of the water is freshwater.

According to the WOGCC, as of August 19, 2018, there are approximately 457 Disposal wells in the state disposing of oil and gas wastewater. Data obtained from the Wyoming Oil and Gas Conservation Commission, for a period ending June 30, 2018, indicates that 4,979,807,439 barrels of water have been injected into underground formations for disposal purposes. These injection wells may also utilize HF depending upon the specific geology of the disposal zone; however, subsequent disposal operations utilize injection pressures below the fracture stress of the receiving formation to ensure containment in the targeted zone. Each formation for which injection is approved must receive an aquifer exemption from the Environmental Protection Agency documenting that the injectate will be properly contained and that the formation receiving the water is not of useable quality (DEQ Class 4 Use).

POTENTIAL SOURCES OF WATER FOR HYDRAULIC FRACTURING

Freshwater-quality water is required to drill the surface-casing section of the wellbore per federal regulations; other sections of the wellbore (intermediate and/or production strings) would be drilled with appropriate quality makeup water as necessary. This is done to protect usable water zones from contamination, to prevent mixing of zones containing different water quality/use classifications, and to minimize total freshwater volumes. With detailed geologic well logging during drilling operations, geologists/mud loggers on location identify the bottoms of these usable water zones, which aids in the proper setting of casing depths.

Several sources of water are available for drilling and/or HF in WY. Because WY's water rights system is based in the prior appropriation doctrine, water cannot be diverted from a stream/reservoir or pumped out of the ground for drilling and/or HF without reconciling that diversion with the prior appropriation doctrine. Like any other water user, companies that drill or hydraulically fracture oil and gas wells must adhere to WY water laws when obtaining and using specific sources of water.

Below is a discussion of the sources of water that could potentially be used for HF. The decision to use any specific source is dependent on BLM authorization at the APD stage and the ability to satisfy the water appropriation doctrine. BLM must also consult in accordance with the Endangered Species Act (ESA) as amended (16 U.S .C. 1531 et seq.) with the U.S Fish and Wildlife Service (FWS on projects resulting in consumptive water use over de minimus levels, in the Platte and Colorado River Basins of WY. Where this is an issue, USFWS was consulted during the preparation of the appropriate RMP and would again be consulted on a case by case basis. From an operators' standpoint, the decision regarding which water source will be used is primarily driven by the economics associated with procuring a specific water source.

Water transported from outside the state. The operator may transport water from outside the state. As long as the transport and use of the water carries no legal obligation to Wyoming, this is an allowable source of water from a water rights perspective.

Irrigation water leased or purchased from a landowner. The landowner may have rights to surface water, delivered by a ditch or canal that is used to irrigate land. The operator may choose to enter into an agreement with the landowner to purchase or lease a portion of that water. This is allowable, however, in nearly every case, the use of an irrigation water right is likely limited to irrigation uses and cannot be used for well drilling and HF operations. To allow its use for drilling and HF, the owner of the water right and the operator must apply to change the water right through a formal process.

Treated water or raw water leased or purchased from a water provider. The operator may choose to enter into an agreement with a water provider to purchase or lease water from the water provider's system. Municipalities and other water providers may have a surplus of water in their system before it is treated (raw water) or after treatment that can be used for drilling and HF operations. Such an arrangement would be allowed only if the operator's use were compliant with the water provider's water rights.

Water treated at a wastewater treatment plant leased or purchased from a water provider. The operator may choose to enter into an agreement with a water provider to purchase or lease water that has been used by the public, and then treated as wastewater.

Municipalities and other water providers discharge their treated wastewater into the streams where it becomes part of the public resource, ready to be appropriated once again in the priority system. But for many municipalities a portion of the water that is discharged has the character of being "reusable." As a result, it is possible that after having been discharged to the stream, it could be diverted by the operator to be used for drilling and HF operations. Such an arrangement would only be appropriate with the approval of the WY State Engineer's Office (WSEO) and would be allowed only if the water provider's water rights include uses for drilling and HF operations.

New diversion of surface water flowing in streams and rivers. New diversion of surface waters in most parts of the state are rare because the surface streams are already "over appropriated," that is, the flows do not reliably occur in such a magnitude that all of the vested water rights on those streams can be satisfied. Therefore, the only time that an operator may be able to divert water directly from a river is during periods of high flow and less demand. These periods do occur but not reliably or predictably.

Produced Water. The operator may choose to use water produced in conjunction with oil or gas production at an existing oil or gas well. The water that is produced from an oil or gas well is under the administrative purview of the WSEO and is either non-tributary, in which case, it is administered independent of the prior appropriation doctrine; or is tributary, in which case, the depletions from its withdrawal must be fully augmented if the depletions occur in an over-appropriated basin. The result in either case is that the produced water is available for consumption for other purposes, not just oil and gas operations. The water must not be encumbered by other needs and the operator must obtain a proper well permit from the WSEO before the water can be used for drilling and HF operations.

Reused or Recycled Drilling Water. Water that is used for drilling of one well may be recovered and reused in the construction of subsequent wells. The BLM encourages reuse and recycling of both the water used in well drilling and the water produced in conjunction with oil or gas production. However, as described above, the operator must obtain the right to use the water for this purpose.

On-Location Water Supply Wells. Operators may apply for, and receive, permission from the WSEO to drill and use a new water supply well. These wells are usually drilled on location to provide an on-demand supply. These industrial-type water supply wells are typically drilled deeper than nearby domestic and/or stock wells to minimize drawdown interference, and have large capacity pumps. The proper construction, operation and maintenance, backflow prevention and security of these water supply wells are critical considerations at the time they are proposed to minimize impacts to the well and/or the waters in the well and are under the jurisdiction of the WSEO. Plugging these wells are also under the jurisdiction of the WSEO.

POTENTIAL IMPACTS TO USABLE WATER ZONES

Impacts to freshwater supplies can originate from point sources, such as chemical spills, chemical storage tanks (aboveground and underground), industrial sites, landfills, household septic tanks, and mining activities. Impacts to usable waters may also occur through a variety of oil and gas operational sources which may include, but are not limited to, pipeline and well casing failure, and well (gas, oil and/or water) drilling and construction of related facilities. Similarly, improper construction and management of open fluids pits and production facilities could

degrade ground water quality through leakage and leaching.⁵

Should hydrocarbons or associated chemicals for oil and gas development, including HF, exceeding EPA/WDEQ standards for minimum concentration levels migrate into culinary water supply wells, springs, or usable water systems, it could result in these water sources becoming non-potable. Water wells developed for oil and gas drilling could also result in a draw down in the quantity of water in nearby residential areas depending upon the geology; however, it is not currently possible to predict whether or not such water wells would be developed.

Usable groundwater aquifers are most susceptible to pollution where the aquifer is shallow (within 100 feet of the surface depending on surface geology) or perched, are very permeable, or connected directly to a surface water system, such as through floodplains and/or alluvial valleys or where operations occur in geologies which are highly fractured and/or lack a sealing formation between the production zone and the usable water zones. If an impact to usable waters were to occur, a greater number of people could be affected in densely populated areas versus sparsely populated areas characteristic of WY.

Potential impacts on usable groundwater resources from fluid mineral extraction activities can result from the five following scenarios:

- Contamination of aquifers through the introduction of drilling and/or completion fluids through spills or drilling problems such as lost circulation zones.
- Communication of the induced hydraulic fractures with existing fractures potentially allowing frac fluid migration into usable water zones/supplies. The potential for this impact is likely dependent on the local hydraulic gradients where those fluids are dissolved in the water column. To date, this is an unproven theory.
- Cross-contamination of aquifers/formations that may result when fluids from a deeper aquifer/formation migrate into a shallower aquifer/formation due to improperly cemented well casings.
- Localized depletion of unconfined groundwater availability.
- Progressive contamination of deep confined, shallow confined, and unconfined aquifers if the deep confined aquifers are not completely cased off, and geologically isolated, from deeper units. An example of this would be saltwater intrusion resulting from sustained drawdown associated with the pumping of groundwater.

The impacts above could occur as a result of the following processes:

Improper casing and cementing.

A well casing design that is not set at the proper depths or a cementing program that does not properly isolate necessary formations could allow oil, gas or HF fluids to contaminate other aquifers/formations.

Natural fractures, faults, and abandoned wells.

If HF of oil and gas wells result in new fractures connecting with established natural fractures, faults, or improperly plugged dry or abandoned wells, a pathway for gas or contaminants to migrate underground may be created posing a risk to water quality. The potential for this impact is currently unknown but it is generally accepted that the potential decreases with increasing distance between the production zone and usable water zones. This potential again is dependent upon the site specific conditions at the well location.

Fracture growth.

A number of studies and publications report that the risk of induced fractures extending out of the target formation into an aquifer—allowing hydrocarbons or other fluids to contaminate the aquifer—may depend, in part, on the formation thickness separating the targeted fractured formation and the aquifer. For example, according to a 2012 Bipartisan Policy Center report, the fracturing process itself is unlikely to directly affect freshwater aquifers because fracturing typically takes place at a depth of 6,000 to 10,000 feet, while drinking water aquifers are typically less than 1,000 feet deep. Fractures created during HF have not been shown to span the distance between the targeted formation and freshwater bearing zones. If a parcel is sold and development is proposed in usable water zones, those

⁵ See Subject RMP, Chapter 4, Environmental Consequences, for additional information.

operations would have to comply with federal and/or state water quality standards or receive a Class 5 designation from the WDEQ.

Fracture growth and the potential for upward fluid migration, through coal and other geologic formations depend on site-specific factors such as the following:

1. Physical properties, types, thicknesses, and depths of the targeted formation as well as those of the surrounding geologic formations.
2. Presence of existing natural fracture systems and their orientation in the target formation and surrounding formations.
3. Amount and distribution of stress (i.e., in-situ stress), and the stress contrasts between the targeted formation and the surrounding formations.

Hydraulic fracture stimulation designs include the volume of fracturing fluid injected into the formation as well as the fluid injection rate and fluid viscosity; this information would be evaluated against the above site specific considerations.

Fluid leak and recovery (flowback) of HF fluids.

It is theorized that not all fracturing fluids injected into the formation during the HF process may be recovered. It is theorized that fluid movement into smaller fractures or other geologic substructures can be to a point where flowback efforts will not recover all the fluid or that the pressure reduction caused by pumping during subsequent production operations may not be sufficient to recover all the fluid that has leaked into the formation. It is noted that the fluid loss due to leakage into small fractures and pores is minimized by the use of cross-linked gels.

Willberg et al. (1998) analyzed HF flowback and described the effect of pumping rates on cleanup efficiency in initially dry, very low permeability (0.001 md) shale. Some wells in this study were pumped at low flowback rates (less than 3 barrels per minute (bbl/min)). Other wells were pumped more aggressively at greater than 3 bbl/min. Thirty- one percent of the injected HF fluids were recovered when low flowback rates were applied over a 5-day period. Forty-six percent of the fluids were recovered when aggressive flowback rates were applied in other wells over a 2-day period. In both cases, additional fluid recovery (10 percent to 13 percent) was achieved during the subsequent gas production phase, resulting in a total recovery rate of 41 percent to 59 percent of the initial volume of injected HF fluid. Ultimate recovery rate however, is dependent on the permeability of the rocks, fracture configuration, and the surface area of the fracture(s).

The ability of HF chemicals to migrate in an undissolved or dissolved phase into a usable water zone is likely dependent upon the location of the sealing formation (if any), the geology of the sealing formation, hydraulic gradients and production pressures. The following discussion, adapted from: Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs; Chapter 3 Characteristics of CBM Production and Associated HF Practices (3-5EPA 816-R-04-003, June, 2004), takes place where there is not a sealing formation between the fractured formation and usable waters; the two zones are separated by approximately 1000' of earth in the Powder River Basin of WY.

HF Fluids can remain in the subsurface unrecovered, due to “leak off” into connected fractures and the pores of rocks. Fracturing fluids injected into the primary hydraulically induced fracture can intersect and flow (leak off) into preexisting smaller natural fractures. Some of the fluids lost in this way may occur very close to the well bore after traveling minimal distances in the hydraulically induced fracture before being diverted into other fractures and pores. Once “mixed” with the native water, local and regional vertical and horizontal gradients may influence where and if these fluids will come in contact with usable water zones, assuming that there is inadequate recovery either through the initial flowback or over the productive life of the well. Faults, folds, joints, etc., could also alter localized flow patterns as discussed below.

The following processes can influence effective recovery of the fracture fluids:

Check-Valve Effect

A check-valve effect occurs when natural and/ or newly created fractures open and HF fluid is forced into the

fractures when fracturing pressures are high, but the fluids are subsequently prevented from flowing back toward the wellbore as the fractures close when the fracturing pressure is decreased (Warpinski et al., 1988; Palmer et al., 1991a). A long fracture can be pinched-off at some distance from the wellbore. This reduces the effective fracture length. HF fluids trapped beyond the “pinch point” are unlikely to be recovered during flowback and oil/gas is unlikely to be recovered during production.

In most cases, when the fracturing pressure is reduced, the fracture closes in response to natural subsurface compressive stresses. Because the primary purpose of hydraulic fracturing is to increase the effective permeability of the target formation and connect new or widened fractures to the wellbore, a closed fracture is of little use. Therefore, a component of HF is to “prop” the fracture open, so that the enhanced permeability from the pressure-induced fracturing persists even after fracturing pressure is terminated. To this end, operators use a system of fluids and “proppants” to create and preserve a high- permeability fracture-channel from the wellbore deep into the formation.

The check-valve effect takes place in locations beyond the zone where proppants have been placed (or in smaller secondary fractures that have not received any proppant). It is possible that some volume of stimulation fluid cannot be recovered due to its movement into zones that were not completely “propped” open.

Adsorption and Chemical Reactions

Adsorption and chemical reactions can also prevent HF fluids from being recovered. Adsorption is the process by which fluid constituents adhere to a solid surface and are thereby unavailable to flow with groundwater. Adsorption to coal is likely; however, adsorption to other geologic material (e.g., shale, sandstone) is likely to be minimal. Another possible reaction affecting the recovery of fracturing fluid constituents is the neutralization of acids (in the fracturing fluids) by carbonates in the subsurface.

Movement of Fluids Outside the Capture Zone

Fracturing fluids injected into the target zone flow into fractures under very high pressure. The hydraulic gradients driving fluid flow away from the wellbore during injection are much greater than the hydraulic gradients pulling fluid flow back toward the wellbore during flowback and production (pumping) of the well. Some portion of the fracturing fluids could be forced along the hydraulically induced fracture to a point beyond the capture zone of the production well. The size of the capture zone will be affected by the regional groundwater gradients, and by the drawdown caused by producing the well. Site-specific geologic, hydrogeologic, injection pressure, and production pumping details should provide the information needed to estimate the dimension of the production well capture zone and the extent to which the fracturing fluids might disperse and dilute.

Incomplete Mixing of Fracturing Fluids with Water

Steidl (1993) documented the occurrence of a gelling agent that did not dissolve completely and actually formed clumps at 15 times the injected concentration in an induced fracture. Steidl also directly observed, in his mined-through studies, gel hanging in stringy clumps in many other induced fractures. As Willberg et al. (1997) noted, laboratory studies indicate that fingered flow of water past residual gel may impede fluid recovery. Therefore, some fracturing fluid gels appear not to flow with groundwater during production pumping and remain in the subsurface unrecovered. Such gels are unlikely to flow with groundwater during production, but may present a source of gel constituents to flowing groundwater during and after production.

Authorization of any future proposed projects, would require full compliance with local, state, and federal regulations and laws that relate to surface and groundwater protection and would be subject to routine inspections by the BLM and the Wyoming Oil and Gas Commission as described in Memorandum of Understanding WY920-94-09-79, dated September 21, 1994, prior to approval.

GEOLOGIC HAZARDS (INCLUDING SEISMIC/LANDSLIDES)

Potential geologic hazards caused by HF include induced seismic activity. Induced seismic activity could indirectly cause surficial landslide activity where soils/slopes are susceptible to failure.

Landslides involve the mass movement of earth materials down slopes and can include debris flows, soil creep, and slumping of large blocks of material. There are no identified landslides in the project area [Kemmerer RMP (2010), Pinedale RMP (2008), Green River RMP (1997), Rock Springs RMP Revision, and Rawlins RMP (2008) Chapter 2,

Affected Environment and/or Summary of the Management Situation Analysis; Wyoming State Geological Survey (2011)].

Earthquakes occur when energy is released due to blocks of the earth's crust moving along areas of weakness or faults. Earthquakes attributable to human activities are called "induced seismic events" or "induced earthquakes." In the past several years induced seismic events related to energy development projects have drawn heightened public attention. Although only a very small fraction of injection and extraction activities at hundreds of thousands of energy development sites in the United States have induced seismicity at levels that are noticeable to the public, seismic events caused by or likely related to energy development have been measured and felt in Alabama, Arkansas, California, Colorado, Illinois, Louisiana, Mississippi, Nebraska, Nevada, New Mexico, Ohio, Oklahoma, and Texas.

A study conducted by the National Academy of Sciences⁶ studied the issue of induced seismic activity from energy development. As a result of the study, they found that: (1) the process of hydraulic fracturing a well as presently implemented for shale gas recovery does not pose a high risk for inducing felt seismic events; and (2) injection for disposal of waste water derived from energy technologies into the subsurface does pose some risk for induced seismicity, but very few events have been documented over the past several decades relative to the large number of disposal wells in operation.

The potential for induced seismicity cannot be made at the leasing stage; as such, it will be evaluated at the APD stage should the parcel be sold/issued, and a development proposal submitted.

SPILL RESPONSE AND REPORTING

Spill Prevention, Control, and Countermeasure (SPCC) - EPA's rules include requirements for oil spill prevention, preparedness, and response to prevent oil discharges to navigable waters and adjoining shorelines. The rule requires that operators of specific facilities prepare, amend, and implement SPCC Plans. The SPCC rule is part of the Oil Pollution Prevention regulation, which also includes the Facility Response Plan (FRP) rule. Originally published in 1973 under the authority of §311 of the Clean Water Act, the Oil Pollution Prevention regulation sets forth requirements for prevention of, preparedness for, and response to oil discharges at specific non-transportation-related facilities. To prevent oil from reaching navigable waters and adjoining shorelines, and to contain discharges of oil, the regulation requires the operator of these facilities to develop and implement SPCC Plans and establishes procedures, methods, and equipment requirements (Subparts A, B, and C). In 1990, the Oil Pollution Act amended the Clean Water Act to require some oil storage facilities to prepare Facility Response Plans. On July 1, 1994, EPA finalized the revisions that direct facility owners or operators to prepare and submit plans for responding to a worst-case discharge of oil.

In addition to EPA's requirements, operators must provide a plan for managing waste materials, and for the safe containment of hazardous materials, per 43 CFR § 3171 with their APD proposal. All spills and/or undesirable events are managed in accordance with Notice to Lessee (NTL) 3-A and WY Information Memorandums 2008-028: *NTL- 3A Reporting Requirements* and 2009-021 *Guidance & Standards for Response to Oil & Gas-Related Spills & Clean-Up Criteria*. Regulations found at 43 CFR 3162.5(c) provide BLM with the necessary regulatory framework for responding to all spills and/or undesirable events related to hydraulic fracturing operations.

PUBLIC HEALTH AND SAFETY

The intensity, and likelihood, of potential impacts to public health and safety, and to the quality of usable water aquifers is directly related to proximity of the proposed action to domestic and/or community water supplies (wells, reservoirs, lakes, rivers, etc.) and/or agricultural developments. The potential impacts are also dependent on the extent of the production well's capture zone and well integrity. Standard Lease Notice No.1 specifies that development is generally restricted within a quarter mile of occupied dwellings and within 500 feet of riparian habitats and wetlands, perennial water sources (rivers, springs, water wells, etc.) and/or floodplains. Intensity of impact is likely dependent on the density of development. Further information related to the rate of development is provided in the Leasing Environmental Analysis.

⁶ Induced Seismicity Potential in Energy Technologies, National Academy of Sciences, 2012

HF White Paper Table									
Field Office (Year of RFD)	Proj. Num. of CBM wells	Projected Number of Non-CBM/ Conventional Wells	Max Frac Vol. CBM (gal. x 1,000)	Total Est. H2O for CBM (x 1,000)	Max Frac Volume Non-CBM (gal. x 1,000)	Total Est. H2O for Non-CBM (x 1,000,000)	Total Projected H2O for HF (gal. x 1,000)	Total Projected H2O for HF (barrels)	Total Project ed H2O for HF (acre-feet)
BFO (2012)	10,343	3,865	300	3,102,900	5,000	19,325	22,427,900	711,996,824	67,736.09
BHB (2010) (WFO/ CYFO)	150	1,890	300	45,000	5,000	9,450	9,495,000	301,428,571	28,676.52
CFO (2005)	700	2,100	300	210,000	5,000	10,500	10,710,000	340,000,000	32,346.03
NFO (2004)	0	30	300	0	5,000	150	150,000	4,761,905	453.03
LFO (2009)	861	2,566	300	258,300	5,000	12,830	13,088,300	415,501,587	39,528.90
RFO (2004)	4,655	4,655	300	1,396,500	5,000	23,275	24,671,500	783,222,221	74,512.14
RSFO (GRRM P/ 1991)	300	1,258	300	90,000	5,000	6,290	6,380,000	202,539,682	19,268.69
RSFO (JMH/ 2002)	50	314	300	15,000	5,000	1,570	1,585,000	50,317,460	4,786.97
KFO (2006)	640	220	300	192,000	5,000	1,100	1,292,000	41,015,873	3,902.06
PFO (2006)	600	8,580	300	180,000	5,000	42,900	43,080,000	1,367,619,046	130,108.96
Total	18,299	25,478		5,489,700		127,390	132,879,700	4,218,403,168	401,319

Calculation assumes 100% of HF H2O is freshwater.

Conversion factor: gallons to barrels: *0.0317460317 Conversion factor: barrels to acre feet: /10511.3365126

5.4 Water Resources

Surface water hydrology within the area is typically influenced by geology, soil characteristics, precipitation, and vegetation. Anthropogenic factors that currently affect surface include livestock grazing management, private, commercial, and industrial development, recreational use, drought, and vegetation control treatments. Based on best available data, the vast majority of the nominated parcels are within the following HUC8 watersheds: Lower Wind, Lighting, Little Wind, Badwater, and Antelope HUC8 units. Groundwater hydrology within the area is influenced by geology and recharge rates.

Groundwater quality and quantity can be influenced by precipitation, water supply wells and various disposal activities. Groundwater quality across the applicable field offices varies with depth from potable waters with low total dissolved solids (TDS) to highly saline, non-potable sources. Groundwater quality in Wyoming is regulated by three agencies. The Wyoming Department of Environmental Quality (WDEQ) Water Quality Division (WQD) regulates groundwater quality for the uses of Wyoming aquifers. Public groundwater systems are regulated by the U.S. Environmental Protection Agency (USEPA). Both of these agencies have chemical standards for groundwater uses under their respective regulations. The third agency that regulated groundwater quality in Wyoming is the Wyoming Oil and Gas Conservation Commission (WOGCC). The WOGCC regulates the disposal of wastewater that does not meet domestic, livestock, irrigation and other general use standards.

Groundwater in Wyoming are classified with respect to water quality in order to apply the standards set by the WDEQ/WQD per Water Quality Rules and Regulation Chapter 8-Quality Standards for Wyoming Groundwaters (Wyoming Department of Environmental Quality, 2018). The standards that are set are as follows:

- Class I: Groundwater that is suitable for domestic use ((TDS<500 mg/L)
- Class II: Groundwater that is suitable for agricultural (irrigation) use where soil conditions and other factors are adequate for such use (TDS<2,000 mg/L)
- Class III: Groundwater that is suitable for livestock (TDS<5,000 mg/L)
- Class IV: Groundwater that is suitable for industry
- Class IV (A): Groundwater that has a TDS concentration not in excess of 10,000 mg/L
- Class IV (B): Groundwater that has a TDS concentration in excess of 10,000 mg/L.
- Class V: Groundwater that is associated with commercial deposits of hydrocarbons (oi and gas) or other minerals or is a geothermal energy resource
- Class VI: Groundwater that may be unusable or unsuitable for use and could be so contaminated that it would be economically or technologically impractical to make useable, or is located in such a way, including depth below the surface, so as to make use economically and technologically impractical.

Along with the criteria for meeting groundwater quality standards based on intended use, regulations contained in 43 CFR § 3172 Drilling Operation on Federal and Indian Oil and Gas Leases must be followed. These regulations establish national standards for the minimum levels of performance expected from operators and lessees when conducting drilling operations on Federal lands. Contained within these regulations are the requirements to protect and isolate usable water zones. Usable water zones are defined as water bearing layers that contain up to 10,000 mg/L of TDS. For reference, Table 18 defines levels of TDS to the salinity levels of the water.

Table 18. USGS Salinity Classification (Heath, 1983)

Classification	Total Dissolved Solids mg/L
Fresh	0-999
Slightly saline	1,000-2,9999
Moderately saline	3,000-9,999
Very saline	10,000-34,999

Briny	More than 34,999
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Most of the groundwater in Wyoming is used for industrial, domestic and livestock/irrigation purposes. The information contained in Appendix 5.3, Hydraulic Fracturing White Paper (see section entitled Operational Issues/Water Availability and Consumption Estimates) is incorporated by reference.

Several parcels contain land with private surface overlying federal minerals (i.e., split-estate). The private surface lands have or have the potential to contain private residences and associated facilities such as domestic or stock water supply wells. Lands used as rangeland can also have stock water supply wells.

WIND RIVER BASIN

Areas of Oil and Gas Activities

Oil and gas activities are spread across the Wind River Basin and appear to have an affinity along primarily northwest-southeast intrabasinal faults. Both oil and gas are produced in the basin and preference for hydrocarbon phase is play-dependent.

Potential hydrocarbon production zones include the Tertiary Lower Wind River and Fort Union/Shotgun Formations; the Cretaceous Lance, Meeteetse, Mesa Verde, Cody Shale, and Frontier Formations; the Cretaceous-Jurassic Morrison Formation; the Jurassic Nugget Formation; the Triassic Chugwater Group; the Permian-Carboniferous Phosphoria and Tensleep Sandstone Formations (WSGS, 2024, 1.).

Identification of Usable Water Zones and Aquifers

The two principal groundwater-bearing zones and water well production in vicinity of these parcels is from Quaternary age unconsolidated deposit aquifers (alluvium) and the aquifer/usable water zones of the Eocene age Upper Wind River Formation, which is up to 5000 ft thick in the Wind River Basin. Both aquifers are considered major aquifers in the Wind River Basin and are both important sources of useable groundwater. These aquifers have limited continuity and are variegated with complex interbedded clay, shale, silt, and conglomerate beds and lenticular sand layers of variable extents and thicknesses.

Characterization of Usable Water Zones and Aquifers and Usage

Generally, water wells in alluvial aquifers and the usable water zones and aquifer of the Upper Wind River Formation in the Wind River Basin average around 100ft depths with some wells up to 1000ft deep (WSGS, 2024, 2.). Water quality from the alluvial aquifers in the Wind River Basin are generally fresh or moderately saline with TDS concentrations ranging from 102 to 4,630 mg/L, with a median of 539 mg/L (WSGS, 2012). Water quality from the Wind River aquifer is variable throughout Wind River Basin and TDS concentrations from water wells include mostly fresh water (67% of samples) and range from slightly saline to moderately saline ranging from 224 mg/L to 5,110 mg/L, with a median of 707 mg/L (WSGS, 2012). TDS concentrations from produced water samples from the Wind River aquifer are slightly saline to briny and range from 1,060 to 38,800 mg/L, with a median of 2,730 mg/L (WSGS, 2012).

Other major aquifers within the Wind River Basin include the Nugget Sandstone, Tensleep Sandstone, Madison Limestone, and Bighorn Dolomite in which fluid stratification generally occurs with more buoyant hydrocarbons overlying brines and usable water combined with interbedded shales and other less porous rocks serve as geologic isolation of hydrocarbons and brines from usable water, but notably at depth or on the fringes of the basin.

Geological Isolation of Usable Water Zones and Aquifers

Less porous Eocene through Miocene inter-bedded shales and tight sandstones, fluid stratification of buoyant hydrocarbons, faulting and discontinuous stratigraphy can independently or collectively geologically isolate

hydrocarbon zones from brine and usable water zones. Similarly, inter-bedded shales within the Wind River Formation locally isolates usable water zones from lower Wind River productive hydrocarbon zones and collectively from productive hydrocarbon zones in deeper hydrocarbon reservoirs.

Engineered Protection of Usable Water Zones and Aquifers

Oil and gas wells permitted in vicinity of these parcels generally have surface casing between 1500 and 2500ft deep within the Wind River Formation or top of the Fort Union/Shotgun Formation and serve as engineered protections of useable water zones and aquifer in the Upper Wind River Formation. Applications for Permit to Drill (APDs) further analyze the significantly more local requirements for casing and cementing to ensure isolation of usable water zones on a well pad by well pad and borehole by borehole basis.

POWDER RIVER BASIN

Areas of Oil and Gas Activities

Oil and gas activities are spread across the Powder River Basin and appear to have an affinity along primarily northwest-southeast intrabasinal faults as well as systematic west-southwest to east-northeast trending counter-regional faults. Both oil and gas are produced in the basin and preference for hydrocarbon phase is play-dependent.

Potential hydrocarbon production zones include the Tertiary Fort Union Formation coalbeds, Upper Cretaceous Parkman, Sussex, Shannon, Niobrara, Carlile Shale, and Frontier Formations; the Lower Cretaceous Mowry Shale, Muddy, and Cloverly Formations; and the Carboniferous Minnelusa Formation.

Identification of Usable Water Zones and Aquifers

The Lower Eocene Wasatch Formation; the Tongue River, Lebo, and Tullock Members of the Paleocene Fort Union Formation; and the Upper Cretaceous Fox Hills Sandstone Formation are the primary aquifer and usable water zones in the Powder River Basin (Long et al, 2014). The overall Lower Tertiary system can be as thick as 7,180ft (Long et al, 2014) and is the most widely utilized source of groundwater (Taboga et al, 2019) with wells down to 2000ft. The Fox Hills system as thick as 7,600ft and is used for groundwater near the basins periphery (Taboga et al, 2017). In the Wyoming portion of the Powder River Basin, these intervals have varying permeability due to a variety of depositional environments resulting in lithostratigraphic complexity (Taboga et al, 2017) and to faulting and fracturing (Long et al, 2014).

Characterization of Usable Water Zones and Aquifers and Usage

The Fort Union Formation contains coal seams interbedded with lenticular sandstones to more ubiquitous shales (Taboga et al, 2017) while the Fox Hills Formation near-shore deltaic mudstones to sandstones (Tischerman et al, 2022). Production in the Fort Union coal seams and adjacent sandstones is geologically isolated from usable water zones by changes in lithology, stratigraphic barriers between formational bedding as well as fracturing and faulting (Tobago et al, 2017). The Wasatch Formation shales derived from nonmarine fluvial and paludal (swamp/marsh environments) (Taboga et al, 2019) serves as a more localized traditional confining unit for the biogenically-sourced hydrocarbons found in the Fort Union coal seams.

Water Quality in Usable Water Zones and Aquifers

Water quality in the Wasatch ranges from 160 to 8,620mg/L with a median of 1,125mg/L while Fort Union ranges from 113 to 5,480 mg/L with a median of 1,015mg/L (Taboga et al, 2019). In the Lance, water quality ranges from 244 to 3,060 mg/L with a median of 946mg/L and the Fox Hills ranges from 28 to 3,520 mg/L with a median of 1,170 mg/L (Taboga et al, 2019).

Geological Isolation of Usable Water Zones and Aquifers

The Upper Cretaceous Lewis Shale and Pierre Shale Formations combine to provide a more traditional confining unit cap to the basin's primarily thermogenically-sourced hydrocarbons and geologically isolating those hydrocarbons from the primary usable water zones for the basin. Usable water zones in deeper hydrocarbon bearing formations geologically isolate more buoyant hydrocarbons and brines from usable water zones. Isolation is also facilitated by stratigraphic barriers in bedding and by faulting and fracturing.

Engineered Protection of Usable Water Zones and Aquifers

Oil and gas wells generally employ surface casing and cement to protect the Wasatch and Fort Union usable water zones. Some wells may require intermediate or production casing and cement to protect the Fox Hills usable water zones. Further during plugging operations of particularly older wells, usable water zones are identified and plugged with to further isolate those zones. Applications for Permit to Drill (APDs) further analyze the significantly more local requirements for casing and cementing to ensure isolation of usable water zones on a well pad by well pad and borehole by borehole basis.

GREEN RIVER BASIN

Areas of Hydrocarbon Activity

There are multiple areas of oil and gas activities in the Green River Basin. The Pinedale Anticline (PA), the Jonah Infill Drilling (JID), and the Normally Pressured Lance (NPL) project areas lie in the north of the basin while additional activities occur along the Moxa Arch and along the LaBarge Platform along the western flank of the basin (WOGCC Data Explorer, Figure 1 from Lynds and Lichtner, 2016). The hydrocarbon phase produced in each of these areas is predominantly natural gas with historic oil production.

Potential hydrocarbon production zones include the Paleocene Fort Union Formation, Upper Cretaceous Lance, Lewis Shale, Almond, Ericson, Rock Springs, Baxter Shale, and Frontier Formations; the Lower Cretaceous Bear River and Cloverly Formations; the Jurassic Nugget Formation, and the Carboniferous Tensleep Sandstone and Madison Limestone. Of these, the Mesaverde, Lance, and Fort Union are generally the target intervals in the project areas listed above.

Identification of Usable Water Zones and Aquifers

Across the Green River Basin, undivided Tertiary formations and intervals occur stratigraphically younger than the Lower Eocene Wasatch Group (Wasatch) and include uppermost Eocene through Miocene aged stratigraphic intervals (Love et al., 1993). The undivided Tertiary interval, the Wasatch, and to a much lesser extent the Paleocene Fort Union Formation are the most common usable water zones. Of these, the Wasatch is the primary aquifer and usable water zone in the Green River Basin. The Wasatch occurs from the surface to approximately 6,200ft deep at an average thickness of about 8,000 feet.

Characterization of Usable Water Zones and Aquifers and Usage

The undivided Tertiary section overlies the Wasatch and does not include the Green River which interfingers with the Wasatch, but for these analyses will be included in the undivided Tertiary section. In general, the undivided Tertiary section is highlighted by the Miocene Bishop Conglomerate and the Battle Spring conglomerates and sandstones as well as other isolated permeable sandstone aquifers that intertongue with silts and shales.

The Wasatch both conformably and unconformably overlies the Fort Union and is largely comprised of alluvial deposits, more specifically, fluvial sands, flood plain shales, and coal that interfingers with the more lacustrine facies of the undivided Tertiary formations (Roberts, 2005). As such, local initial geologic isolation generally begins at deposition and persists through lithification to present day.

The Fort Union contains coal seams embedded with lenticular-shaped sandstones and includes fluvial, paludal, and lacustrine shales, claystones, and mudstones (Lynds and Lichtner, 2016) which geologically isolate from usable

water zones by changes in lithology, stratigraphic barriers between formational bedding as well as fracturing and faulting (Tobago et al, 2017).

Water Quality in Usable Water Zones and Aquifers

Water quality measured by total dissolved solids (TDS) in milligrams per liter (mg/L) in the undivided Tertiary ranges from 1,401 to 20,531mg/L with a mean average of 5,035mg/L (Taboga et al, 2020) including 4 samples (11% of samples) >10,000 mg/L. These 4 samples are clustered near the center of the western flank of the Green River basin. For the Wasatch, TDS values range from 1,050 to 4,775 mg/L with a mean average of 2,778 mg/L while the Fort Union ranges from 1,542 to 3,519 mg/L with a mean average of 2,531 mg/L (Taboga et al, 2020).

Geological Isolation of Usable Water Zones and Aquifers

In general, the lacustrine shales of the Wasatch and undivided Tertiary as well as the Upper Cretaceous Lewis Shale combined with interbedded shales, mudstones, and siltstones with their lower permeabilities in the Paleocene Fort Union Formation and the Upper Cretaceous Fox Hills and Lance Formations provide a confining regional seal to the basin's deeper primarily thermogenically sourced hydrocarbons and thereby geologically isolating those hydrocarbons from the primary usable water zones for the basin (Buursink et al., 2012; Finn et al., 2005; Love et al., 1993). Usable water zones in deeper hydrocarbon bearing formations are locally geologically isolated from more buoyant hydrocarbons and brines. Isolation is also facilitated by stratigraphic barriers namely finer-grained, less-permeable shales and siltstones in bedding and by faulting and fracturing. Buursink et al., 2012 identify multiple carbon dioxide storage assessment units within the Green River Basin that have intervening shales and tight sandstones that serve as confining units for geologic carbon sequestration.

Engineered Protection of Usable Water Zones and Aquifers

Oil and gas wells generally employ surface casing and cement to protect the undivided Tertiary, the Wasatch and the Fort Union usable water zones. Some wells may require intermediate or production casing and cement to protect the in these or other usable water zones. Further during plugging operations of particularly older wells, usable water zones are identified and plugged to further isolate those zones. Applications for Permit to Drill (APDs) further analyze the significantly more local requirements for casing and cementing to ensure isolation of usable water zones on a well pad by well pad and borehole by borehole basis.

WASHAKIE-GREAT DIVIDE BASIN

Areas of Hydrocarbon Activity

The Wamsutter area is the primary area of oil and gas activities. This area is defined as the area along the Wamsutter Arch and across the Washakie Basin. Secondary areas of oil and gas activities occur along the Rock Springs Uplift and along the northern flank of the Great Divide Basin (WOGCC Data Explorer, Figure 1 from Lynds and Lichtner, 2016). The main hydrocarbon phase produced in the Wamsutter is predominantly natural gas and coal-bed methane gas with more historic oil production.

Potential hydrocarbon production zones include the Paleocene Fort Union Formation, Upper Cretaceous Lance, Lewis Shale, Almond, Ericson, Rock Springs, Baxter Shale, and Frontier Formations; the Lower Cretaceous Muddy Sandstone and Cloverly Formations; the Jurassic Nugget Formation, and the Carboniferous Weber Sandstone and Madison Limestone.

Identification of Usable Water Zones and Aquifers

Across the Green River Basin, undivided Tertiary formations and intervals occur stratigraphically younger than the Lower Eocene Wasatch Group (Wasatch) and include uppermost Eocene through Miocene aged stratigraphic intervals (Love et al., 1993). The undivided Tertiary interval, the Wasatch, and to a much lesser extent the Paleocene

Fort Union Formation are the most common usable water zones. Of these, the Wasatch is the primary aquifer and usable water zone in the Green River Basin. The Wasatch occurs from the surface to approximately 6,200ft deep at an average thickness of about 8,000 feet.

Characterization of Usable Water Zones and Aquifers and Usage

The undivided Tertiary section overlies the Wasatch and does not include the Green River which interfingers with the Wasatch, but for these analyses will be included in the undivided Tertiary section. In general, the undivided Tertiary section is highlighted by the Miocene Bishop Conglomerate and the Battle Spring conglomerates and sandstones as well as other isolated permeable sandstone aquifers that intertongue with silts and shales.

The Wasatch both conformably and unconformably overlies the Fort Union and is largely comprised of alluvial deposits, more specifically, fluvial sands, flood plain shales, and coal that interfingers with the more lacustrine facies of the undivided Tertiary formations (Roberts, 2005). As such, local initial geologic isolation generally begins at deposition and persists through lithification to present day.

The Fort Union contains coal seams embedded with lenticular-shaped sandstones and includes fluvial, paludal, and lacustrine shales, claystones, and mudstones (Lynds and Lichtner, 2016) which geologically isolate from usable water zones by changes in lithology, stratigraphic barriers between formational bedding as well as fracturing and faulting (Tobago et al, 2017).

Water Quality in Usable Water Zones and Aquifers

Water quality from 1,000-2,000 feet measured by total dissolved solids (TDS) in milligrams per liter (mg/L) in the undivided Tertiary ranges from 2,433 to 8,458 mg/L with a mean average of 4,863mg/L (Taboga et al, 2020). For the Wasatch, TDS values range from 1,320 to 10,611 mg/L with a mean average of 4,971 mg/L with one sample (6% of all Wasatch samples) >10,000 mg/L. The Fort Union ranges from 1,938 to 14,366 mg/L with a mean average of 4,690 mg/L (Taboga et al, 2020) with one sample (14% of all Fort Union samples) >10,000 mg/L.

From 2,000-3,000 feet, water quality for the undivided Tertiary ranged from 2,407 to 18,421 mg/L with 2 samples (22% of all undivided Tertiary samples) >10,000 mg/L.

Geological Isolation of Usable Water Zones and Aquifers

In general, the lacustrine shales of the Wasatch and undivided Tertiary as well as the Upper Cretaceous Lewis Shale combined with interbedded shales, mudstones, and siltstones with their lower permeabilities in the Paleocene Fort Union Formation and the Upper Cretaceous Fox Hills and Lance Formations combine to provide a confining regional seal to the basin's deeper primarily thermogenically sourced hydrocarbons and thereby geologically isolating those hydrocarbons from the primary usable water zones for the basin (Buursink et al., 2012; Finn et al., 2005; Love et al., 1993). Usable water zones in deeper hydrocarbon bearing formations are locally geologically isolated from more buoyant hydrocarbons and brines. Isolation is also facilitated by stratigraphic barriers namely finer-grained, less-permeable shales and siltstones in bedding and by faulting and fracturing. Buursink et al., 2012 identify multiple carbon dioxide storage assessment units within the Washakie and Great Divide basins that have intervening shales and tight sandstones that serve as confining units for geologic carbon sequestration.

Engineered Protection of Usable Water Zones and Aquifers

Oil and gas wells generally employ surface casing and cement to protect the undivided Tertiary, the Wasatch and the Fort Union usable water zones. Some wells may require intermediate or production casing and cement to protect the in these or other usable water zones. Further during plugging operations of particularly older wells, usable water zones are identified and plugged to further isolate those zones. Applications for Permit to Drill (APDs) further analyze the significantly more local requirements for casing and cementing to ensure isolation of usable water zones on a well pad by well pad and borehole by borehole basis.

DENVER-JULESBURG BASIN

Areas of Hydrocarbon Activity

There are multiple areas of oil and gas activities in the Denver-Julesburg basin. According to the WOGCC Data Explorer the primary activity for current hydrocarbon activity is to the east and northeast of Cheyenne. Also based on the WOGCC Data Explorer, potential future development based on APD's are located to the southeast, east, and northeast of Cheyenne.

Identification and Characterization of Usable Water Zones and Aquifers

The Denver-Julesburg groundwater basin contains different types of aquifers depending on the location within the basin. The majority of the basin consists of Upper Tertiary (sandstone) aquifers such as the Ogallala in the southeastern portion of the Denver-Julesburg basin and the Arikaree in the northeastern section of the basin. The Ogallala aquifer is composed of permeable parts and is primarily used as source water for domestic, stock, industrial, public-supply, and irrigation (Taucher et al. 2013). The Arikaree aquifer is a water source for domestic and stock use, and less often for public-supply and irrigation.

The aquifers in the Denver-Julesburg basin have different characteristics leading to availability of usable water. The Ogallala aquifer has a maximum thickness of 300ft consisting of siltstone and gravel with aquifer recharge rates of 1-5 inches per year. The Arikaree aquifer has a maximum thickness of 500ft with lithology consisting of tuffaceous. This aquifer generally has a 1-5 inches per year recharge rate with maximum yields of 1,000 gallons per minute.

Quaternary aquifers within the Denver-Julesburg basin consist of alluvial deposits along streams and rivers which supply most of the region's irrigation wells. Quaternary eolian aquifers are located in the northern section of the basin east of Chugwater, WY. These eolian deposits are composed of fine-grained sand that is about 50ft thick (Rapp et al. 1957). The Quaternary aquifers are alluvium consisting of sand, gravel, silt and clay and generally have a maximum thickness of 200ft, with recharge rates ranging from 0.25 to 5 inches per year and maximum yields of 1,000 gallons per minute or higher.

The Mesozoic aquifers in the Denver-Julesburg basin are the Fox Hills and Lance Aquifers. The Fox Hills and the Lance aquifers are located in the northern portion of the basin near Hawk Springs, WY. The Fox Hills aquifer lithology is made of shale with a maximum thickness of 500ft and a maximum water yield of 1,000 gallons per minute. The Fox Hills aquifer is overlain by the Lance aquifer and confined from below by the Pierre confining unit (Taucher et al. 2013). The aquifer has not been developed extensively because of the deep burial depth and availability of water from shallower aquifers and has primarily been used for oil and gas activity. However, the town of Pine Bluffs, WY uses this aquifer as public-water supply in the eastern part of Laramie County.

The Lance aquifer lithology consists of siltstone shale with thin coal and carbonaceous shale beds. The maximum thickness is 3,000ft and a maximum water yield of 250 gallons per minute. The majority of the Lance aquifer is deeply buried and used for oil and gas development. The Lance aquifer exhibits low water yields, and is also used for domestic and stock watering where the aquifer is closer to the ground surface. Water in the Lance aquifer is used as public-supply in the town of Rolling Hills, WY.

Water Quality in Usable Water Zones and Aquifers

Groundwater quality varies within the Denver-Julesburg basin. The Quaternary alluvial aquifers within this basin are considered mostly fresh water with TDS concentrations ranging from 207mg/L to 1,530mg/L with a median of 528mg/L (Taucher et al. 2013). Quaternary eolian aquifers east of Chugwater, WY are currently used for domestic, agriculture and livestock water and meet the water quality standards for these uses.

Upper Tertiary aquifers such as the Ogallala and Arikaree are both considered freshwater aquifers containing less than 999 mg/L of TDS (Taucher et al. 2013). Water quality samples in the Ogallala aquifer from 120 wells show a TDS concentration ranging from 70mg/L to 1,270mg/L with a median value of 227mg/L. The Arikaree aquifer was

characterized from 40 different wells that were sampled yielding TDS values ranging from 202mg/L to 868mg/L with a median value of 265mg/L.

The Mesozoic aquifer water quality in the Fox Hills and Lance was characterized by water samples collected from wells completed in these formations. Sampling of 19 wells was conducted and showed that 87% of samples collected were considered fresh water with TDS level below 999mg/L. Of the samples collected, TDS concentrations ranged from 264mg/L to 1,950mg/L with a median of 699mg/L. The Fox Hills aquifer has had limited water testing, however has been characterized with TDS levels ranging from 28mg/L to 3,520mg/L.

A study was completed by the State of Wyoming Geological Survey (Toboga et al. 2016) studying the groundwater salinity (TDS) levels in the Denver-Julesburg Basin. The study was conducted using 695 spontaneous measurements from 234 borehole geophysical logs and 14 water quality analyses from oil and gas wells. The study informed estimates of TDS levels based on depths underground. The results are summarized below:

500–999 ft interval: Estimated TDS levels in this interval are below 5,000 mg/L except one well located on the northeastern edge of the basin in an area characterized by TDS concentrations that exceed 5,300 mg/L.

1,000–1,499 ft interval: All estimated TDS concentrations within this interval fall below 5,000 mg/L. However, several areas with TDS levels above 4,000 mg/L are scattered along the western margin of the basin and at one site in the southcentral area.

1,500–1,999 ft interval: One moderately saline well (TDS > 5,000 mg/L) occurs on the northwestern margin of the basin. Areas with TDS levels above 4,000 mg/L are found in the northwest and southwest.

2,000–2,499 ft interval: All estimated TDS concentrations within this interval fall below 5,000 mg/L. Several wells located in the southcentral and western basin exceed 4,000 mg/L.

2,500–2,999 ft interval: Estimated TDS concentrations within this interval also fall below 5,000 mg/L. Several areas with TDS levels above 4,000 mg/L are located on the northern, western and eastern basin margins.

3,000–3,499 ft interval: Only one well, located in the northcentral part of the basin exhibits a salinity of 5,000 mg/L. All other data points fall below 5,000 mg/L. Again, several areas with TDS levels above 4,000 mg/L are scattered throughout the basin.

3,500–3,999 ft interval: Three wells in the northeast and one well on the western margin are moderately saline (5,000 < TDS < 10,000 mg/L).

4,000–4,499 ft interval: Several moderately saline (5,000 < TDS < 10,000 mg/L) wells are located in the south-east and two occur in the north.

4,500–5,000 ft interval: Within this interval, areas with moderate to high salinity have expanded over wider geospatial extents than in the shallower zones discussed above. Two highly saline wells (16,000 and 30,833 mg/L) and one moderately saline (7,000) well occur on the western margin of the basin. Other moderately saline wells are located in northeastern (5,000 and 6,600 mg/L), eastern (5,600, 8,000 and 9,100 mg/L) and southcentral (5,000 and 8,500 mg/L) areas. Additionally, elevated (> 4,000 mg/L) TDS concentrations of peripheral wells illustrate the expansion of saline.

Geological Isolation of Usable Water Zones and Aquifers

Tertiary Miocene and Upper Cretaceous aquifers are regionally isolated from underlying Mesozoic and Paleozoic hydrocarbon formations largely by regionally thick shales in the Upper Cretaceous Pierre Shale and Niobrara formations (Love et al., 1993). Upper Cretaceous aquifer intraformational clays, mudstones, claystones, siltstones, lavas and tuffs with their lower effective porosity and permeability facies provide more local isolation from formationals coals and associated hydrocarbons that may also migrate into formationals sands and conglomerates (Higley and Cox, 2007). Similarly, Mesozoic and Paleozoic intraformational shales, again, with significantly lower

porosity and permeability facies provide local isolation of water zones in otherwise hydrocarbon-rich source and reservoir rocks. The asymmetric architecture of the Denver-Julesburg foreland basin results in steeply dipping formations in a roughly north-south strike orientation on the western flank of the basin resulting in regionally more shallow structures in which to trap hydrocarbons (Higley and Cox, 2007). As a result, the more gently east to west dipping eastern flank of the basin results in larger more areal water zones in the same Mesozoic and Paleozoic formations with occasional trapping configuration into which hydrocarbons may have migrated. However, these are at depths which TDS concentrations are expected to exceed moderate levels (>4,000 mg/L) as indicated above (Taboga et al., 2016) and are considered Class III to Class IV groundwater quality.

Engineered Protection of Usable Water Zones and Aquifers

Oil and gas wells generally employ surface casing and cement to protect the undivided Tertiary, the Wasatch and the Fort Union usable water zones. Some wells may require intermediate or production casing and cement to protect the in these or other usable water zones. Further during plugging operations of particularly older wells, usable water zones are identified and plugged to further isolate those zones. Applications for Permit to Drill (APDs) further analyze the significantly more local requirements for casing and cementing to ensure isolation of usable water zones on a well pad by well pad and borehole by borehole basis.

BIGHORN BASIN

Areas of Hydrocarbon Activity

There are multiple areas of oil and gas activities in the Bighorn basin. According to the WOGCC Data Explorer the primary activity for current hydrocarbon activity is to the east of Worland and west of Ten Sleep. There is also established activity between Greybull and Tensleep, northwest of Lovell and north of Meeteetse, WY. Based on the WOGCC Data Explorer, potential future development using APD's, some develop is showing in these previously mentioned areas.

Identification and Characterization of Usable Water Zones and Aquifers

The Bighorn groundwater basin contains different types of aquifers depending on the location within the basin. Quaternary aquifers are located within the Bighorn basin that are widely used sources of water for domestic, stock, irrigation and public supply purposes. These aquifers are composed of sand and gravel interbedded with finer grained sediments such as silt and clays (Taucher et al., 2012). These aquifers are generally located along stream margins as alluvial aquifers.

Tertiary aquifers make up a large portion of the Bighorn basin which coincides with the boundaries of the structural basin and is thousands of feet thick in the interior basin. The tertiary aquifer is confined from below by the Cody confining unit, which separates the system from underlying lower and middle Mesozoic aquifers (Taucher et al., 2012). The largest aquifers in the tertiary aquifer system are the Willwood aquifer, Fort Union aquifer, and the Lance aquifer.

The Willwood aquifer and the Fort Union aquifer have similar characteristics which are located near the land surface throughout the basin. The Willwood aquifer is located in the central part of the basin while the Fort Union aquifer is located along the Bighorn basin margins and are comprised of fine to coarse grained sandstone beds interbedded with shale and other fine-grained rocks with some coal deposits (Taucher et al., 2012). The thickness of the Willwood Formation is 800ft to 5,000ft while the thickness of the Fort Union Formation is about 1,000ft. Both of these aquifers have a low water yield at about 10 gal/min with recharge rates of .25-.75 inches per year, however are both important sources of water which supply irrigation, stock, and domestic use.

The Lance aquifer is a thick sandstone interbedded with shale, claystone, siltstone, and thin coal. The thickness of the aquifer is 800ft to 1,800ft (Lowy et al., 1976). The Lance Formation is overlain by the Fort Union Formation and underlain by the Meeteetse Formation. Confined conditions predominate with unconfined areas where outcrops exist. The Lance aquifer currently supports water use for sock, domestic, and limited public-supply with 1-5 inches per year of recharge.

The Mesaverde aquifer is Tertiary/Upper Cretaceous-age and composed of lenticular, clayey to silty, fine-grained sandstone interbedded with shale, claystone, siltstone, bentonite, and thin coal (Lowy et al., 1976). The Mesaverde aquifer thickness ranges from 900ft to 1,800ft and has primarily been used for oil and gas wells.

The Frontier aquifer is classified as a minor aquifer consisting of lenticular, fine to medium grained sandstone interbedded with shale and bentonite. Water yields in this basin are likely low with primary uses occurring for stock and domestic use. The thickness of this aquifer ranges from 400ft to 700ft.

The Cloverly aquifer is considered a major aquifer consisting of upper Dakota sandstone interbedded with silty sandstone and shale with thickness that ranges from 85ft to 470ft. The aquifer is confined above by the Mowry-Thermopolis confining unit and below by the Morrison confining unit. The Cloverly aquifer is primarily used for domestic and stock watering.

The Paleozoic aquifer system in the Gros Ventre unit basin comprises of four hydrogeologic units. Major aquifers are Tensleep aquifer, Flathead aquifer and Madison-Bighorn aquifer and the minor aquifer is the Goose Egg aquifer. The Paleozoic aquifer is confined from above by overlying low permeability shales of the Chugwater-Dinwoody unit and confined from below by the Gallatin-Gros Venture unit. The Tensleep aquifer and the Madison-Bighorn aquifer are the most developed of these four. Some wells completed in this aquifer have water yields of hundreds to thousands of gallons per minute. The aquifers in the Paleozoic system have been developed for domestic, public-supply, *irrigation* and stock use.

Water Quality in Usable Water Zones and Aquifers

Groundwater quality varies within the Bighorn basin. Water samples were collected from 108 wells to test TDS levels in the Quaternary alluvial aquifer. The Quaternary alluvial aquifers within this basin are considered mostly fresh water with TDS concentrations ranging from 67mg/L to 9,160mg/L with a median of 1,080mg/L. The Willwood aquifer was characterized with samples from 92 wells. Of the samples collected, 51 percent of the waters were slightly saline and the others were considered fresh water. TDS concentrations ranges from 352mg/L to 9,000mg/L with median value of 1,350mg/L. The Fort Union aquifer was characterized by 31 wells with TDS levels ranging from fresh to moderately saline waters. TDS concentrations ranged from 372mg/L to 4,920mg/L with a median value of 1,550mg/

Water quality testing was conducted in the Lance aquifer using 53 wells. TDS concentrations ranged from 1,101mg/L to 6,827mg/L with a mean value of 3,989mg/L (Taboga et al., 2022). The Mesaverde aquifer was sampled using 24 wells to test water quality. TDS concentrations ranged from 2,062mg/L to 22,911mg/L with a mean value of 6,246mg/L indicating the aquifer is slightly saline (Taboga et al., 2022). The Frontier aquifer was sampled using 62 wells to test water quality. TDS concentrations ranged from 1,288mg/L to 32,425mg/L with a mean value of 8,132mg/L indicating the aquifer is slightly saline (Taboga et al., 2022). Water quality in this aquifer is generally considered poor with most uses needing treatment before use. The TDS mean value is moderately saline.

Cloverly Water quality is variable, generally fresh in outcrop areas declining with depth. Water quality was evaluated using 32 wells. TDS concentrations ranged from 1,657mg/L to 25,539mg/L with a mean value of 8,234mg/L and is generally considered moderately saline (Taboga et al., 2022).

Paleozoic aquifers have varying water quality and salinity/TDS levels. The Tensleep aquifer was tested for water quality conditions using 118 wells. TDS concentrations ranged from 1,050mg/L to 23,440mg/L with a mean value of 4,247mg/L and is generally considered slightly saline with 18% of samples testing over 5,000mg/L (Taboga et al., 2022). The Madison-Bighorn aquifer was sampled for water quality analysis using 44 wells. TDS concentrations ranged from 1,017mg/L to 15,557mg/L with a mean value of 3,067mg/L and is generally considered slightly saline with 7% of samples testing over 5,000mg/L (Taboga et al., 2022). The Flathead aquifer water quality was characterized with a limited number of six wells. Of the samples, TDS concentrations ranged from 2,729mg/L to 12,889mg/L with a mean value of 5,065mg/L and is generally considered slightly saline with 17% of samples testing over 5,000mg/L (Taboga et al., 2022). The Goose-Egg aquifer was also characterized with a limited number of 10 wells. TDS concentrations ranged from 205mg/L to 2,690mg/L with a mean value of 397mg/L (Taucher et al., 2012). The water contained in this aquifer is generally considered fresh water.

Toboga et al. quantified salinity/TDS levels in the Bighorn Basin and how they vary with depth. See Table .

Table 5-1. Summary statistics for salinity levels in the Bighorn Basin by depth intervals feet below ground surface (ft bgs) prevalence of saline groundwater Source: ((Taboga et al., 2022).

Depth Interval (ft bgs)	Salinity as TDS (mg/L)								Sample size
	Minimum	10 th percentile	25 th percentile	Median	75 th percentile	90 th percentile	Maximum	Mean	
1,000–2,000	1,078	1,495	2,165	4,882	9,265	15,946	38,862	7,570	52
2,000–3,000	1,062	1,404	2,408	4,284	9,286	13,109	41,683	7,213	70
3,000–4,000	1,022	1,884	2,654	4,585	8,027	12,505	62,163	6,631	92
4,000–5,000	1,081	1,974	2,715	3,855	8,608	13,860	52,680	6,643	79
5,000–6,000	1,183	1,823	2,843	4,289	10,573	18,297	54,513	8,609	59
6,000–7,000	1,101	2,069	2,677	4,507	9,579	16,177	115,997	9,361	49
7,000–8,000	1,017	1,534	2,965	6,334	12,845	22,234	66,676	9,991	48
8,000–9,000	1,604	1,893	2,807	4,640	8,487	17,715	22,461	7,257	30
9,000–10,000	1,050	1,626	2,232	3,752	6,041	17,448	38,111	6,817	25
10,000–11,000	2,052	2,512	5,771	13,397	17,579	20,653	55,482	14,820	24
11,000–12,000	1,810	2,838	3,376	6,615	14,005	22,678	22,911	9,664	11
>12,000	3,080	3,763	6,057	8,377	12,640	17,235	18,275	9,589	7

Geological Isolation of Usable Water Zones and Aquifers

Thicker shale formations such as the Late Cretaceous Cody Shale and Lewis Shale formations more regionally isolate the shallower and stratigraphically younger Tertiary Willwood, Fort Union, and Lance aquifers from older, deeper, and stratigraphically older oil and gas prone intervals (Love et al., 1993). Hydrocarbons in the Bighorn Basin occur primarily in Paleozoic formations such as the Phosphoria, Tensleep Sandstone, and Madison Limestone, but secondarily occurs in Mesozoic formations such as the Frontier, Mowry Shale, Cloverly, Morrison, and Sundance. Lower porosity and permeability Paleozoic and Mesozoic inter-formational shales, mudstones, and siltstones provide initial isolation of hydrocarbons from formational water zones (Taboga et al., 2022, Lillis and Selby, 2012). Basin centric and structurally deeper “water legs” are expected to be further structurally isolated from hydrocarbon bearing zones in updip trapping configurations.

Engineered Protection of Usable Water Zones and Aquifers

Oil and gas wells generally employ surface casing and cement to protect the undivided Tertiary, the Wasatch and the Fort Union usable water zones. Some wells may require intermediate or production casing and cement to protect the in these or other usable water zones. Further during plugging operations of particularly older wells, usable water zones are identified and plugged to further isolate those zones. Applications for Permit to Drill (APDs) further analyze the significantly more local requirements for casing and cementing to ensure isolation of usable water zones on a well pad by well pad and borehole by borehole basis.

5.5 Parcel Evaluation in Greater Sage-Grouse Habitat

BLM Wyoming follows the ARMPA which indicates that prioritization would occur for leasing and development. In addition, BLM Wyoming uses the information provided from various court decisions to describe the prioritization process. Using the ARMPA, along with the decisions from the court cases, the WSO describes the prioritization process in the following paragraphs.

For all steps in the prioritization process, the field office first completes a review of the parcel(s) and applies the appropriate stipulations in conformance with the applicable FO RMP. Once a field office has completed its review, the parcel list is sent back to the BLM WSO, who then reviews the parcels; any parcel(s) located in Non-habitat are given first priority (see Section 3.4, Table 3-24 (P1)) within Prioritization Flowchart (below). The BLM WSO provides the proposed parcel list to the WGFD to review and provide comments to the BLM at the same time the parcels are being reviewed by the field offices. Once the WSO receives the input from both the field offices and the WGFD, the stipulations applied by the field office are reviewed to ensure input from the WGFD has been captured by field office stipulations.

Parcels completely within GHMA (or partially in non-habitat and partially within GHMA) were then reviewed to verify that the BLM is using the most current GHMA/PHMA boundaries, the most current lek location database information (maintained by WGFD) and most current Winter Concentration Area locations before being considered for sale offering. All parcels with the 'Evaluating Label' of GHMA were recommended to be offered for lease (see Section 3.4, Table 3-24 (P2) and in the flowchart below).

For all parcels (wholly or partially) located within designated PHMA, the BLM WSO has taken the following approach. Identify whether any of the PHMA parcels are located in an area in which a habitat and/or population metric indicates a need for further review (MD SSS 13, pg. 37-38, 2015 ARMPA). If a parcel is located within one of these areas, BLM WSO will use the adaptive management process outlined in Appendix D of the 2015 ARMPA and notify the BLM WY SD (P5). The decision made by the SD to lease or defer the parcel(s) would be based on criteria located in Appendix D along with other available information.

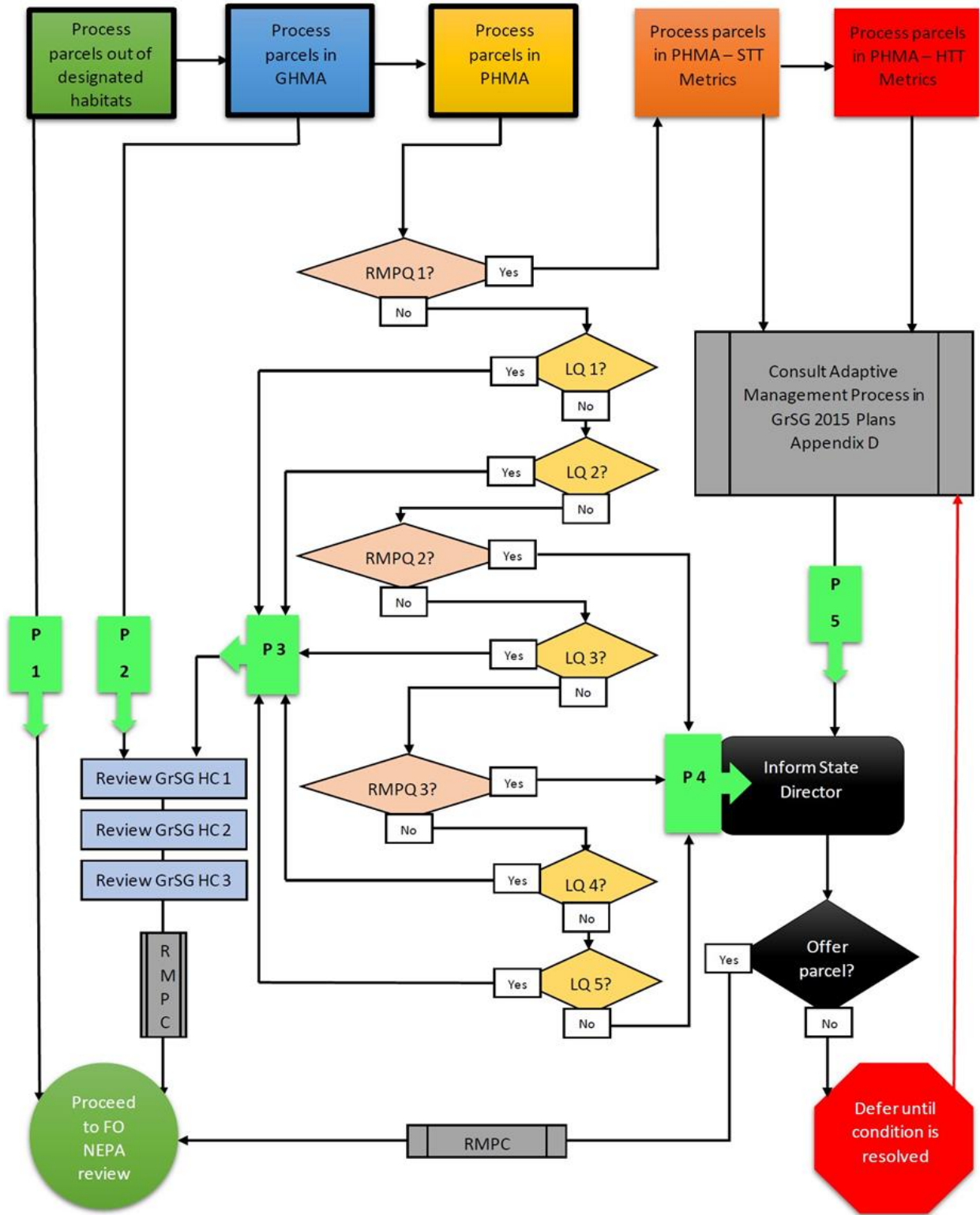
For the parcels with an Evaluation Label of PHMA, the WY BLM Resource Policy and Management division (WY930) reviewed potential conflicts between Greater sage-grouse (GRSG) and parcels nominated for the 2025 Q1 lease sale based on steps 1-7 in the following. GHMA parcels were assessed based on steps 5-9 in the following.

1. 2021 population adaptive management triggers [P5] as determined by the Wyoming Statewide Adaptive Management Working Group (SAMWG; 2022-2024 population trends have yet to be formally examined). The SAMWG was established in consultation with the State's Sage-grouse Implementation Team (SGIT) to assess abnormal GRSG population trends. The SAMWG includes representatives from BLM, Forest Service, USFWS, NRCS and an equal number of representatives from the State of Wyoming. This group reviewed an assessment of GRSG population trends conducted by regional WGFD wildlife and habitat biologists detailed in the document *Sage-grouse Areas of Concern-2021* and answers to a subsequent questionnaire given to the GRSG Local Working Groups (LWG) asking for any concerns or concurrence with the WGFD assessment. These documents were used by the SAMWG to inform the determination of core area population triggers that had tripped in 2021. In May 2022 SAMWG issued a letter to LWGs in Wyoming establishing that 16 core areas in the State had tripped a population trigger in 2021: Blacks Fork, Buffalo, Douglas, Greater South Pass, Hanna, Heart Mountain, Hyattville, Jackson, Natrona, Newcastle, North Glenrock, North Laramie, Oregon Basin, Sage, South Rawlins, and Washakie. Adaptive management triggers are used to identify potential concerns in GRSG population trends so that managers have the opportunity to address and respond to unintended negative impacts to GRSG populations before consequences become severe or irreversible (leases in PHMA only).
2. 2021 habitat adaptive management triggers [P5] calculated as described in EO 2019-3 from data provided by the WGFD (2022 - 2024 data unavailable). A subcommittee convened in 2020 that included representatives from the WGFD, BLM and USFWS developed habitat trigger calculations following WY EO 2019-3 and the 2015 GRSG ARMPA as: a habitat trigger (no differentiation between hard and soft habitat triggers) could be tripped if habitat loss is greater than 60% normal range of variation in one year or loss is greater than 40% over a 3-year trend. Normal range of variation was established by examining

available habitat reductions in each Core Area, using DDCT-derived data, compared to the state-wide average of habitat loss in all Core Areas. A habitat trigger was tripped if loss deviated more than 60% over 1 year or more than 40% over 3 years from the state-wide average habitat loss. Each Core Area is weighted in the calculation based on the proportion of sage-grouse habitat in the entire state contained within the core area to provide biological relevance for habitat loss thresholds. The BLM determined that habitat triggers had been tripped in 9 core areas in 2021: Buffalo, Daniel, Greater South Pass, Hanna, Hyattville, Natrona, North Gillette, Thunder Basin, and Washakie. As with population triggers, habitat triggers are used to identify potential concerns in GRSG habitat trends so that managers have the opportunity to address and respond to unintended negative impacts to GRSG habitats before consequences become severe or irreversible (leases in PHMA only).

3. Land Health Standards (LHS) status [P4] of livestock grazing allotments. If one or more of the allotments overlapping the parcel did not meet LHS, the parcel was considered to have not met LHS (leases in PHMA only).
4. High value seasonal habitats [P4] established as PHMA within 4 miles of occupied GRSG leks located in PHMA if a population or habitat trigger is tripped (leases in PHMA only).
5. Genetic connectivity [IM-2023-007] identified as areas in the top 15% cumulative connectivity (i.e., the most likely connectivity pathways among GRSG genetic nodes as estimated by Cross et al. (2023; Royal Society Open Science 10:220437; reference Fig. 4) and situated within 3.1 miles (Manier et al. 2014; USGS OFR 2014-1239) of an occupied GRSG lek as defined by the WGFD (Whitford and Bish 2022). Deferral recommendations based on IM-2023-007 are under leasing preference criteria #2 (presence of important fish and wildlife habitats or connectivity areas, giving preference to lands that would not impair the proper functioning of such habitats or corridors; leases in PHMA and GHMA).
6. Existing anthropogenic infrastructure [P4] within proposed parcel estimated from 2020 NAIP imagery. Existing anthropogenic infrastructure located near proposed leases is also considered in deferral recommendations (leases in PHMA and GHMA).
7. Proximity (within 4 miles; to align with DDCT [WGFD] monitoring scales) to BLM priority restoration areas [P4] (leases in PHMA and GHMA).
8. Potential for indirect impacts on high value seasonal habitats (Spence et al. 2017; PLoS ONE 12:0185885) established as potential surface disturbance occurring within 3.1 miles of high value seasonal habitats as described above (leases in GHMA only).
9. Areas of concern based on WGFD regional wildlife and habitat biologist assessment of GRSG population trends detailed in the document *Sage-grouse Areas of Concern-2021*. Note that although this document is the same document used by SAMWG to determine population adaptive management triggers in PHMA as described above, the regional trend assessments presented in the document included populations in GHMA (leases in GHMA only).

Figure 5.5-1. Greater Sage-grouse Prioritization Flowchart



Refer to the list below when using the flowchart for prioritizing leasing.

Prioritization (P)

The prioritization arrows summarize consideration of parcels in addition to the sequence displayed across the top of the flowchart. The early enhanced review steps within the flowchart allow for categorization of proposed lease parcels into the following five leasing priorities:

P1 - These parcels receive the highest priority for leasing.

P2 - These parcels receive the second highest priority for leasing (after considering all parcels nominated for the current sale categorized as **P1**).

P3 - These parcels receive the third highest priority for leasing (after considering all parcels nominated for the current sale categorized as **P1** and/or **P2**).

P4 - These parcels receive the fourth highest priority for leasing (after considering all parcels nominated for the current sale categorized as **P1**, **P2**, and/or **P3**).

P5 - These parcels receive the lowest priority for leasing (after considering all parcels nominated for the current sale categorized as **P1**, **P2**, **P3**, and/or **P4**).

Greater Sage-Grouse (GrSG) Habitat Conditions (HC)

Wyoming State Office staff (WYSO 930) will verify with the appropriate agency that the most current and accurate data layers are available to the Field Offices for the review of these parcels. Current agreements with the Wyoming Game and Fish Department (WGFD) will be followed for utilization of the most current published data. A value assessment of these conditions and the subsequent application of RMP Management Decisions and Lease Stipulations will be addressed within the Leasing EA or during site-specific development proposal NEPA reviews. GrSG HCs within the flowchart refer to three types of potentially changing habitat designation conditions:

GrSG HC 1 – Verify with the BLM Wyoming Division of Resource Policy and Management (WYSO 930) that the most current PHMA boundaries are utilized.

GrSG HC 2 – Verify with WYSO 930 that the most current lek location database is utilized.

GrSG HC 3 – Verify with WYSO 930 that the most current Winter Concentration Area location database is utilized.

Resource Management Plan Questions (RMPO)

Resource Management Plan Questions within the flowchart address RMP-level population and habitat disturbance/restoration/suitability conditions. The following three questions will provide evaluation considerations to determine prioritization of parcels located within PHMA.

RMPO 1 - Discuss the Adaptive Management metrics with WYSO 930 for the PHMA unit containing this parcel.

RMPO 2 – Is the parcel within an area of a prioritized restoration project?

RMPO 3 - Is the parcel within an allotment that is failing to achieve the land health standards and conform with the guidelines?

Leasing Questions (LQ)

Leasing Questions within the flowchart encourage new development in lands already impacted by development factors. Parcels meeting any of the criteria in these questions are given a higher priority for leasing. Parcels meeting none of the criteria should be considered of lower priority for leasing. The following five questions inform the decision to categorize a parcel as either Priority 3 or Priority 4.

LQ 1 - Does the parcel lie within an area where law or regulation indicates that offering the lands for leasing is in the government's interest, due to drainage of Federal minerals, 43 CFR § 3162.2-2, or trespass drilling on unleased lands?

LQ 2 - Is the parcel within an existing Federal oil and gas unit?

LQ 3 - Is the parcel immediately adjacent or proximate to existing oil and gas leases and development operations or other land use development?

LQ 4 - Is the parcel within an area with a completed field-development Environmental Impact Statement or Master Leasing Plan that allows for adequate site-specific mitigation and is in conformance with the objectives and provisions in the GrSG Plans?

LQ 5 - Is the parcel in an area with higher potential for development (for example, considering the oil and gas potential maps developed by the BLM for the GrSG Plans)?

Resource Management Plan Conditions (RMPC)

RMPC- Ensure that a decision to lease those lands would conform to the conservation objectives and provisions in the GrSG Plans.

For parcels located in an area where the habitat and/or population metrics are within normal ranges, BLM WSO would identify any parcel(s) where law or regulation indicates that offering the lands for lease would be in the government's best interest. An example would be if any of the parcels are subject to potential fluid minerals drainage from a nearby/adjacent lease (see Table 4-8 for any parcel meeting this criteria). If any of the proposed parcels identified as being in an area where law or regulation indicates that offering the lands is in the government's best interest (LQ1), BLM WSO would apply the appropriate stipulations (P3).

If none of the parcels are identified within the first two criteria, BLM WSO would identify whether any of the parcels are located within an existing federal oil and gas unit (LQ2, see Table 4-8 for any parcel meeting this criteria). If a parcel is located within an existing unit, BLM WSO would apply the appropriate stipulations (P3) to the lease as described in Non-habitat process. Leasing parcels in an existing federal oil and gas unit congregates leases in a particular area, potentially minimizing the amount of surface disturbance.

Any parcels that are not located in an area in which a habitat and/or population metric indicates a need for further review (RMPQ1), in an area where it is the government's best interest to lease (LQ1), or in an existing Federal Oil and Gas Unit (LQ2), BLM WSO will identify any parcel(s) that are located within areas of prioritized restoration projects (RMPQ2, see Table 4-8 for any parcel meeting this criteria). An example of this could be where BLM WY, along with state and local resources and/or private entities, have invested large amounts of time and resources to restore the habitat within an area. These areas would be considered a priority if they are trending toward successful reclamation and new disturbance that may occur as a result of leasing would hinder the continuation of that trend. If a parcel is identified within one of these areas, the BLM WY SD would make the final determination to lease the parcel or defer the parcel (P4). If the SD chooses to lease the parcel, BLM WSO would apply the appropriate sage-grouse stipulations (P3).

If none of the above criteria are met, BLM WSO would identify any of the parcels are located within a completed oil and gas field-development Environmental Impact Statement or Master Leasing Plan area (see Table 4-8 for any parcel meeting this criteria) that allows for adequate site-specific mitigation and is in conformance with the objectives of the Greater Sage-Grouse (GSG) plans (LQ3). Any parcels that meet this criterion would have stipulations applied accordingly (P3).

If any of the above screening criteria are not met, BLM WSO would identify if any of the parcels are located within an allotment that is failing to achieve the land health standards (see Table 4-8 for any parcel meeting this criteria) and conform with the guidelines (RMPQ3). If a proposed parcel is located within an allotment that is failing land health standards, the BLM WY SD will be notified (P4). It will be the discretion of the SD to defer the parcel(s) or lease the parcel(s) based upon the information available concerning the particular allotment. If a parcel is proposed for lease, the appropriate sage-grouse stipulations will be applied (P3).

If none of the parcels are located within the criteria listed above, BLM WSO would identify any parcel that is immediately adjacent or proximate to existing oil and gas leases and development (LQ4, see Table 4-8 for any parcel meeting this criteria). Any parcel adjacent to an existing oil and gas lease or development would have the appropriate stipulations applied (P3).

The BLM WSO would identify any parcel located in an area with high potential for development (LQ5) (i.e. consider the oil and gas potential maps developed by the BLM for the GSG Plans) if none of the above criteria are met. Again, any parcel located within these areas with high potential for development, the BLM WSO would apply the appropriate stipulations (P3).

Finally, the BLM WSO would provide the SD a list of parcels, location, and any additional information required, if none of the criteria are met (P4). This would allow the SD to make an informed decision to lease the parcel during

this sale (P3) or defer and review again during the next sale. The process is also outlined in the flowchart on page 75 with the flowchart guidance on page 76 and 77.

FO NEPA Review

Once all of these reviews are completed, the State Director (SD) and the District Managers (DMs) coordinate and discuss the recommendations and concur on which potential parcels, or portions of parcels move forward for analysis and inclusion into the quarterly CLS environmental assessment (EA). The WSO fluid minerals staff prepares the EA and posts it on the ePlanning website for a 30-day public comment period and then makes changes to the EA, if necessary. The WGFD reviews and comments on the EA at this time as well. A State of Wyoming, WGFD, and BLM Wyoming coordination meeting occurs after the comment period closes. Any major conflicts identified are discussed with the SD and Deputy State Director (DSD) for Lands and Minerals (and other staff if determined necessary by the SD) for a decision on whether to delete, defer or move the parcel forward. The public comments and responses are then posted on ePlanning at the same time the Sale Notice is posted for a 30-day protest period. After the 30-day protest period, the fluid minerals staff reviews the protests and prepares responses. At any point in the review process, parcels or portions of parcels, in addition to those identified through this prioritization process, may be deleted or deferred.

5.6 EA Preparers/Reviewers, Consultation & Coordination

The following individuals or organizations were involved in consultation on issues in the development of this EA.

5.6.1 Outside Agencies or Individuals

Prior to publication of this EA, letters were sent to landowners by the WSO notifying them that the minerals under their surface lands had been nominated for lease and inviting them to participate in the BLM's review. Of the initial 20 parcel nominated for sale, all 20 appear to have at least some portion of the parcel in private fee ownership.

Where surface ownership information was provided, the WSO mailed notification letters to each person's whose information was provided. No comments were received from these surface owners during the initial or extended comment period.

Informal scoping letters were also sent to Native American tribal contacts known or identified as having interest or concerns with oil and gas leasing in the area. No comments were received as a result of sending these letters.

When necessary, notice letters were sent to the Forest Service, Douglas Ranger District and to units of the National Park Service in the northeast regional area of Wyoming. The superintendent of the Fort Laramie National Historic Site has identified concerns with oil and gas development in proximity to the Historic Site for previous sales. Those concerns include activities within the visual setting of the area, effects on visitor experience, and impacts to air quality, water quality and night skies. These are impacts associated with lease development and will be addressed site specifically if a development proposal is submitted. No new issues were identified that would suggest the need to consider alternatives beyond those being addressed in this EA and no specific comments were received from these entities.

In accordance with the BLM/WGFD Memorandum of Understanding WY131, Appendix 5G, the WSO sent the preliminary parcel list to the WGFD to provided an opportunity to review the preliminary parcel list and send their comments back to the BLM WSO. WGFD sent an email/letter to the BLM WSO indicating that they have reviewed the revised preliminary parcel list. BLM WSO has incorporated the WGFD concerns into this EA. The WSO also routinely meets with WGFD Habitat Protection Program personnel as a part of its coordination on oil and gas lease sales.

5.6.2 Internal Preparers and Reviewers

Table 5-2. BLM Wyoming State Office

Name	Title	Responsible for
Erik Norelius	Natural Resource Specialist	Project Manager and Preparer
Allen Stegeman	Natural Resource Specialist	Project Manager and Preparer
Lindsay Abercrombie	Natural Resource Specialist	Project Manager and Preparer
Charis Cooper	Physical Scientist, Air Quality	Air Quality & Climate Change
Richard Jacoby	Physical Scientist, Air Quality	Air Quality & Climate Change
Wendy Huber	Planning & Environmental Coordinator	Planning
Chris Toalson	Economist	Socioeconomics
Jennie Frankus	Planning & Environmental Coordinator	Environmental Justice
Matt Holloran	Wildlife Biologist	Wildlife
Sarah Bullcok	Wildlife Biologist	Wildlife
Chad Mickschl	Hydrology	Water Resources

Table 5-3. BLM High Plains District

Name	Title	Responsible for
High Plains District Office		

Name	Title	Responsible for
Ben Bigalke	Associate District Manager	Review and Leadership support
Renee Hardy	GIS Specialist	GIS Support
Kurt Triscori	Coal State	
Kathleen Lacko	HPD Resource Advisor-Energy	District Project Coordinator
Casper Field Office		
Jesse Bassett	Natural Resource Specialist	CFO Team Lead
David Roehl	Natural Resource Specialist	CFO Team Lead
Kourtney Dooner	Legal Instruments Examiner	
Matthew Clark	Geologist	Geology
Sarah Bassett	Wildlife Biologist	Wildlife Review
Leonard Bloomgren	Outdoor Recreation Planner	Wilderness Review
Renne Hardy	GIS Specialist	CFO GIS Support and Recreation Review and Coal Review
Shane Gray	Hydrologist	Hydrology
Brianne Carter	Realty Specialist	Realty
Dusten Burger	Rangeland Management Specialist	Range
Patrick Walker	Archeologist	Cultural and Paleontology Review
Mike Robinson	Planning and Environmental Coordinator	

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7 Attachments

7.1 Parcel Specific Maps (Wildlife)

The attached maps are used to identify parcel specific interactions with Greater Sage-Grouse and Big Game habitat. Please refer to Chapter 3 for species-specific analysis. The parcel shapefile is available to download to compare to other data sources. Parcel numbers displayed on maps and shapefiles use a prefix of WY-2025-03, which was based on a planned sale date of March 2025.

7.2 Parcel Specific Maps (Leasing and Development)

The attached maps are used to identify existing oil and gas development on a parcel specific level. The parcel shapefile is available to download to compare to other data sources. The parcel shapefile is available to download to compare to other data sources. Parcel numbers displayed on maps and shapefiles use a prefix of WY-2025-03, which was based on a planned sale date of March 2024.

7.3 Lands with Wilderness Characteristics (LWC)

Sec. 603 (43 USC 1782). The Wilderness Act states:

“A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.”

“The word ‘roadless’ refers to the absence of roads which have been improved and maintained by mechanical means to ensure relatively regular and continuous use. A ‘way’ maintained solely by the passage of vehicles does not constitute a road”

Table 7-1. Wilderness Review Checklist for Oil and Gas Lease Parcels for Sale Year 2025, Sale Month 03

Parcel No. WY-2025-03-	More than 5000 ac of roadless land (yes/no)	Imprint of man’s work substantially unnoticeable (yes/no)	Outstanding opportunity for solitude or primitive recreation (yes/no)	Contains natural features of scientific, educational, scenic, or historical value (yes/no)	In Citizens Proposed Wilderness Area (yes/no). If yes but dropped during RMP process, state why.	Field Office Notes or Explanations
1926	No	No	No	No	No	NA
1927	No	No	No	No	No	NA
2006	No	No	No	No	No	NA
7319	No	No	No	No	No	NA