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

Farmington Field Office Competitive Oil and Gas Lease Sale Environmental Assessment
San Juan, Sandoval, Rio Arriba Counties, New Mexico
March and June 2019 as updated in October 2024

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

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
ACEC	area of critical environmental concern
AF	acre-feet
AIB	analyzed in brief
AirToxScreen	Air Toxics Screening Assessment
AO	Authorized Officer
APD	Application for Permit to Drill
APE	area of potential effects
AQRV	air quality–related values
b/d	barrels per day
bbl	barrel(s)
Bcf/d	billion cubic feet per day
BCR	Bird Conservation Region
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	best management practice
C.F.R.	Code of Federal Regulations
CAA	Clean Air Act
CAP	criteria air pollutant
CARMMS	Colorado Air Resources Management Modeling Study
CEQ	Council on Environmental Quality
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COA	condition of approval
CSU	controlled surface use
DMAX8	daily maximum 8-hour
EA	environmental assessment
EIA	U.S. Energy Information Administration
EIS	environmental impact statement
EJ	environmental justice
EMNRD	Department of Energy, Minerals, and Natural Resources
EOI	expression of interest
EOR	enhanced oil recovery

EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
EUR	estimated ultimate recovery
FEMA	Federal Emergency Management Agency
FFO	Farmington Field Office
FLPMA	Federal Land Policy and Management Act of 1976
GHG	greenhouse gas
GIS	geographic information system
GMU	Game Management Unit
GWP	global warming potential
GWPC	Groundwater Protection Council
H_2S	hydrogen sulfide
HAP	hazardous air pollutant
HI	hazard index
HSP	Habitat Stamp Program
HUC	hydrologic unit code
IDT	interdisciplinary team
IM	Instruction Memorandum
IPaC	Information for Planning and Consultation
IPCC	Intergovernmental Panel on Climate Change
IRA	Inflation Reduction Act of 2022
IWG	Interagency Working Group
km	kilometer(s)
LANDFIRE	Landscape Fire and Resource Management Planning Tools
LWC	lands with wilderness characteristics
m	meter(s)
MAGICC	Model for the Assessment of Greenhouse Gas Induced Climate Change
mcf	thousand cubic feet
MGFAA	Mancos-Gallup Formation Analysis Area
MLA	Mineral Leasing Act of 1920
Mt	megatonne(s)
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NEI	National Emissions Inventory
NEPA	National Environmental Policy Act of 1969, as amended
NETL	National Energy Technology Laboratory
NHD	National Hydrography Dataset

NHPA	National Historic Preservation Act of 1966
NHT	national historic trail
NMAAQS	New Mexico Ambient Air Quality Standards
NMAC	New Mexico Administrative Code
NMDGF	New Mexico Department of Game and Fish
NMED	New Mexico Environment Department
NMOCD	New Mexico Oil Conservation Division
NMOSE	New Mexico Office of the State Engineer
NMPM	New Mexico Principal Meridian
NMSO	New Mexico State Office
NO_2	nitrogen dioxide
NORM	naturally occurring radioactive material
NO_X	nitrogen oxide(s)
NPS	National Park Service
NSO	no surface occupancy
NSPS	New Source Performance Standard
NWI	National Wetlands Inventory
O_3	ozone
OAI	Ozone Attainment Initiative
PFYC	Potential Fossil Yield Classification
PM_{10}	particulate matter equal to or less than 10 microns in diameter
$PM_{2.5}$	particulate matter equal to or less than 2.5 microns in diameter
POD	plan of development
ppb	parts per billion
ppm	parts per million
PRPA	Paleontological Resources Preservation Act
PSD	prevention of significant degradation
RfC	reference concentration
RFD	reasonably foreseeable development
RMP	resource management plan
RPFO	Rio Puerco Field Office
SC-GHGs	social cost of greenhouse gases
SHPO	State Historic Preservation Office
SMA	special management area
SO_2	sulfur dioxide
STEO	short-term energy outlook
SWD	saltwater disposal

TCP	traditional cultural property
TDS	total dissolved solids
U.S.C.	United States Code
UIC	underground injection control
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound
VRM	visual resource management

CHAPTER 1. INTRODUCTION

1.1 BACKGROUND

This environmental assessment (EA) documents the Bureau of Land Management (BLM) Farmington Field Office (FFO) review of sixteen parcels (6,179.02 acres) nominated for auction in the BLM FFO March 2019 and June 2019 Competitive Oil and Gas Lease Sales (the Proposed Action). It should be noted that the original March 2019 EA considered 22 parcels. Eight parcels (parcels 10-17) originally included in the Sale are no longer under consideration as the lessee did not respond when BLM inquired regarding updated terms and conditions. The nominated parcels still under consideration are in San Juan, Sandoval, and Rio Arriba Counties, New Mexico (see parcel maps in Appendix A). The nominated lease parcels contain federal minerals managed by the BLM and consist of BLM and BIA administered surface land as well as private surface land. For detailed information on the leasing process, see the following website: https://www.blm.gov/programs/energy-and-minerals/oil-and-gas/leasing/parcel-nominations.

1.2 PURPOSE AND NEED

The BLM's purpose in preparing the EA is to respond to expressions of interest (EOIs) to lease federal oil and gas resources through a competitive leasing process. The need for the action is established by the BLM's responsibility under the Mineral Leasing Act of 1920 (MLA), as amended, to make mineral resources, such as oil and gas, available for development and as part of the BLM's multiple-use and sustained-yield mandate under the Federal Land Policy and Management Act of 1976 (FLPMA).

1.3 DECISION TO BE MADE

The BLM Authorized Officer (AO) will decide whether to make available for lease the nominated lease parcels with or without constraints, in the form of lease stipulations, as provided for in the approved land use plans. If the decision is to make the lands available for lease and subsequently issue a lease, standard terms and conditions under Section 6 of the BLM lease form (Form 3100-11, Offer to Lease and Lease for Oil and Gas), herein referred to as standard terms and conditions, would apply. The BLM AO also has the authority to defer the parcels, based on the analysis of potential effects presented in this EA.
The Decision Record will identify whether the BLM decided to lease the nominated lease parcels and the rationale for the decision.

1.4 CONFORMANCE WITH BLM LAND USE PLANS, OTHER STATUES, REGULATIONS, AND PLANS

1.4.1 BLM Land Use Plan Conformance

The BLM, under the MLA and FLPMA, as amended, must make mineral resources, such as oil and gas, available for development. Additionally, the Federal Onshore Oil and Gas Leasing Reform Act of 1987 states that lease sales shall be held for each state where eligible lands are available at least quarterly and more frequently if the Secretary of the Interior determines such sales are necessary.

Under FLPMA, the BLM must manage public lands, resources, and resource values according to multiple-use, sustained-yield mandate in a manner that will best meet the present and future needs of the public, and in accordance with an approved land use plan or resource management plan (RMP).
For split-estate lands where the mineral estate is an interest owned by the United States, the BLM has no authority over the use of the surface estate; however, the BLM is required to declare how the federal

mineral estate will be managed, including identification of all appropriate lease stipulations (BLM Handbook H-1601-1 and H-1624-1 [BLM 2005, 2018a]). 43 Code of Federal Regulations [C.F.R.] § 3101.1 and 43 C.F.R. § 1601.0-7(b). This Proposed Action aligns with the Farmington Approved RMP (BLM 2003), as amended (BLM 2014, 2015). The nominated lease parcels fall within areas that are open to leasing under the RMPs indicated above, as amended, and are subject to certain stipulations. The nominated lease parcels, lease parcel surface ownership, lease parcel legal description and total acreage, and lease stipulations and notices that apply are detailed in Chapter 2. Appendix A contains parcel maps. Stipulation and lease notice descriptions are detailed in Appendix B.

1.4.2 Relationship to Statutes, Regulations, Policies, and Other Plans

Purchasers of oil and gas lease parcels are required to comply with all applicable federal, state, and local laws and regulations, including obtaining all necessary permits prior to any lease development activities. The BLM is also required to comply with all applicable federal, state, and local laws and regulations, as well as U.S. Department of the Interior policies, when leasing mineral estate and responding to EOIs. Table 1.1 provides a listing of statutes, regulations, policies, and other plans applicable to the leasing decision.

Table 1.1. Relationship to Statutes, Regulations, Policies, and Other Plans

Relevant Statute, Regulation, Policy, or Plan	Relationship to the Proposed Action
Federal Land Policy and Management Act of 1976	FLPMA, 43 United States Code (U.S.C.) § 1701 *et seq*., established guidelines to provide for the management, protection, development, and enhancement of public lands. Section 103 of FLPMA defines public lands as any lands and interest in lands owned by the United States. For split-estate lands where the surface is non-federal and the United States owns the minerals, the BLM has limited authority over use the of the surface estate but manages the mineral estate, in part by identifying all appropriate lease stipulations (BLM Handbook H-1601-1 and H-1624-1 [BLM 2005, 2018a]). 43 C.F.R. § 3101.1 and 43 C.F.R. § 1601.0-7(b). Within the context of the National Environmental Policy Act of 1969, as amended (NEPA), the BLM considers FLPMA compliance when conducting NEPA analyses for mineral leasing actions, and the BLM issues a Finding of No Significant Impact (FONSI) when it determines that the proposed action would not violate any federal, state, tribal, or local law protecting the environment, including but not limited to, the FLPMA's mandate to ensure that undue and/or unnecessary degradation would not occur.
Mineral Leasing Act of 1920	The MLA establishes that deposits of oil and gas owned by the United States are subject to disposition in the form and manner provided by the MLA under the rules and regulations prescribed by the Secretary of the Interior, where consistent with the FLPMA; NEPA, 42 U.S.C. § 4321 *et seq*.; and other applicable laws, regulations, and policies.
43 C.F.R. § 3100 *et seq.*	These regulations govern onshore oil and gas leasing, development, and production of federal minerals.
Federal Onshore Oil and Gas Leasing Reform Act	This Act, 30 U.S.C. § 181 *et seq.*, directs the BLM to conduct quarterly oil and gas lease sales whenever eligible lands are available for leasing.
New Mexico Surface Owner Protection Act	This Act requires operators to provide the surface owner with at least five business days' notice prior to initial entry upon the land for activities that do not disturb the surface, and at least 30 days' notice prior to conducting actual oil and gas operations. Included in this policy is the implementation of a Notice to Lessees, a requirement of lessees and operators of onshore federal oil and gas leases within the state of New Mexico to provide the BLM with the names and addresses of the surface owners of those lands where the federal government is not the surface owner, not including lands where another federal agency manages the surface.
Endangered Species Act (ESA)	The ESA, 16 U.S.C. § 1531 *et seq*., requires all federal departments and agencies to conserve threatened, endangered, and critical and sensitive species and the habitats on which they depend, as well as consult with the U.S. Fish and Wildlife Service (USFWS) on all actions authorized, funded, or carried out by the agency to ensure that the action will not likely jeopardize the continued existence of any threatened and endangered species or adversely modify critical habitat. See the text of stipulation HQ-TES-1 in Appendix B for details.

Relevant Statute, Regulation, Policy, or Plan	Relationship to the Proposed Action
National Historic Preservation Act of 1966 (NHPA)	Leasing is considered an undertaking pursuant to 54 U.S.C. § 300101 *et seq*., commonly known as the NHPA, and specifically, 54 U.S.C. § 306108, commonly known as Section 106 of the NHPA (Section 106). Agencies may follow a phased approach to Section 106 compliance. At the leasing level, existing records reviews, and consultation drive identification of historic properties. Class III field inventories are an important part of identification at the lease-development level. See the text of stipulation HQ-CR-1 in Appendix B for details.
Federal Cave Resource Protection Act	This Act, 16 U.S.C. § 4301 *et seq*., secures and protects significant caves on federal land for the benefit and enjoyment of all people and directs the Secretary of the Interior to inventory and list significant caves on federal lands. Details regarding general cave management; the significant cave nomination, evaluation, and designation process; and cave and karst resource confidentiality noted within the Federal Cave Resource Protection Act are in 43 C.F.R. § 37 (Cave Management).
Inflation Reduction Act of 2022 (IRA)	The IRA made the following major changes to BLM's oil and gas leasing program: • Rescinded the BLM's authority to issue noncompetitive leases under the MLA by striking 30 U.S.C. § 226I. • Removed BLM's authority to issue reversionary noncompetitive leases. • Updated the royalty rate and rental rate lease terms for competitive leases. • Changed the grounds and conditions for certain reinstatements. In addition, Section 50265 of the IRA states that the BLM may not issue a right-of-way for wind or solar energy development on federal land unless it has: 1) held an onshore oil and gas lease sale during the past 120 days and 2) offered the lesser of a "sum total" of either 2,000,000 acres or 50% of the acreage for which EOIs have been submitted for lease sales during the previous 1-year period. The BLM has issued policy guidance to implement the oil and gas leasing provisions in the IRA and provided updated direction on other program components (i.e., Instruction Memorandum [IM] 2023-006 [BLM 2022a], IM 2023-007 [BLM 2022b], IM 2023-008 [BLM 2022c], and IM 2023-010 [BLM 2022d]).
IM 2023-006 – *Implementation of Section 50265 in the Inflation Reduction Act for Expressions of Interest for Oil and Gas Lease Sales* (BLM 2022a)	This IM provides guidance regarding BLM's implementation of IRA Section 50265 with regard to EOIs. The BLM is using the National Fluid Lease Sale System (https://nflss.blm.gov/eoi/list) to track the acreage of EOIs submitted. As stated in IM 2023-006 and IM 2023-036, *Inflation Reduction Act Conditions for Issuing Rights-of-way for Solar or Wind Energy Development* (BLM 2022e), the BLM will prepare a national report and document the review prior to issuing a wind or solar energy right-of-way.
IM 2023-007 – *Evaluating Competitive Oil and Gas Lease Sale Parcels for Future Lease Sales** (BLM 2022b)	This IM provides guidance to BLM offices in selecting parcels to be offered in oil and gas lease sales, and it also supplements IM 2023-010, *Oil and Gas Leasing – Land Use Planning and Lease Parcel Reviews* (BLM 2022d). This IM informs the agency's organization, procedures, and practice.
IM 2023-008 – *Impacts of the Inflation Reduction Act of 2022 (Pub. L. No. 117-169) to the Oil and Natural Gas Leasing Program* (BLM 2022c)	This IM provides the BLM State Offices with guidance for implementing the provisions of the IRA pertaining to EOIs, noncompetitive lease offers, pending competitive leases, and reinstatements. This IM updates expired policy IM 2014-004, *Oil and Gas Informal Expressions of Interest.*
IM 2023-010 – *Oil and Gas Leasing – Land Use Planning and Lease Parcel Reviews* (BLM 2022d)	This IM provides the BLM policy to ensure that oil and gas lease sales are held in accordance with the MLA, 30 U.S.C. § 226; 43 U.S.C. § 3006; and other applicable laws. This policy addresses land use planning, lease parcel review, lease sales, lease issuance, and IM implementation and directs the BLM to incorporate the revised policy, as appropriate, into the affected BLM handbooks and manuals.

* See Appendix C for BLM's evaluation of the nominated lease sale parcels in accordance with IM 2023-007, *Evaluating Competitive Oil and Gas Lease Sale Parcels for Future Lease* Sales (BLM 2022b).

1.5 PUBLIC INVOLVEMENT AND ISSUES

1.5.1 Internal Scoping

Table 1.2. Internal Scoping

Sale	Summary of Scoping
March 2019	The BLM FFO interdisciplinary team (IDT) conducted internal scoping to identify issues, potential alternatives, and data needs by reviewing the leasing actions within the context of the applicable RMP under the National Environmental Policy Act of 1969, as amended (NEPA) framework. IDT meetings were held at the BLM FFO on October 4, 2018, and the week of October 15–19, 2018. Weekly meetings were held with additional BLM FFO IDT members during the parcel review process. Additionally, other resource-specific meetings with resource specialists were held to aid in refining issues related to the proposed lease sale.
June 2019	The BLM FFO IDT conducted internal scoping to identify issues, potential alternatives, and data needs by reviewing the leasing actions within the context of the applicable RMP under the National Environmental Policy Act of 1969, as amended (NEPA) framework. IDT meetings were held at the BLM FFO on December 17, 2018. Weekly meetings were held with additional BLM FFO IDT members during the parcel review process. Additionally, other resource-specific meetings with resource specialists were held to aid in refining issues related to the proposed lease sale.

1.5.2 External Scoping

Table 1.3. External Scoping

Sale	Summary of Scoping
March 2019	A project summary page for the March 2019 Competitive Oil and Gas Lease Sale was posted on the BLM's National NEPA Register website (https://eplanning.blm.gov). The nominated lease parcel information (draft parcel list) was posted on that website for a public scoping period from October 5–19, 2018. The BLM FFO received 21 comment letters via ePlanning during the scoping period for the March 2019 Competitive Oil and Gas Lease Sale. Concerns and comments presented by the public and non-governmental organizations are summarized below: • cultural resources and historic properties; • the nature and extent of planned government-to-government consultation: • greenhouse gas (GHG) emissions as they relate to climate change, and air quality. After reviewing scoping comments, nine parcels totaling 1,482.45 acres within the FFO were identified for deferral due to the concerns raised.

Sale	Summary of Scoping
June 2019	A project summary page for the June 2019 Competitive Oil and Gas Lease Sale was posted on the BLM's National NEPA Register website (https://eplanning.blm.gov). The nominated lease parcel information (draft parcel list) was posted on that website for a public scoping period from January 28 to February 8, 2019. The BLM FFO received seven comment letters via ePlanning during the scoping period for the June 2019 Competitive Oil and Gas Lease Sale. Concerns and comments presented by the public and non-governmental organizations are summarized below: • cultural resources; • greenhouse gas (GHG) emissions as they relate to climate change; • Concerns regarding government-to-government consultation; • NEPA adequacy; • The FFO Resource Management Plan Amendment (RMPA); and • Environmental Justice

1.5.3 Draft EA Public Comment and Response

The March 2019 EA was not made available for a public comment period in 2019. The June 2019 EA was made available March 11 through March 22, 2019, during a public review and comment period.

In addition to the previously held comment period, the revised draft was made available for a public comment period from December 10, 2024, to January 9, 2025. All comments received were reviewed and analyzed. Substantive comments were addressed as appropriate.

1.5.4 Public Protest Period

The March 2019 Competitive Oil and Gas Lease Sale Notice was made available for a protest period from February 11 through February 20, 2019. The June 2019 Competitive Oil and Gas Lease Sale notice was made available for a protest period from April 22 through May 1, 2019. The BLM will resolve protests received, on both sales, prior to issuing leases.

1.5.5 Issues

The Council on Environmental Quality (CEQ) regulations[1], 40 C.F.R. § 1500.4(f), state that the scoping process should be used "to identify important environmental issues deserving of study and to deemphasize unimportant issues, narrowing the scope of the [NEPA] process … accordingly." In accordance with 40 C.F.R. § 1500.4 (e), the agency should "emphasize the portions of the environmental document that are most useful to decision makers and the public and reduce emphasis on background material."

Through scoping, three issues were identified for detailed analysis in this EA:

[1] 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 C.F.R. Part 46, to meet the agency's obligations under NEPA, 42 U.S.C. §§ 4321 *et seq*.

- How would future potential development of the nominated lease parcels affect air quality (particularly National Ambient Air Quality Standards [NAAQS] and volatile organic compounds [VOCs]) in the New Mexico portion of the San Juan Basin?
- How would future potential development of the nominated lease parcels contribute to greenhouse gas (GHG) emissions and climate change?
- How would future potential development of the nominated lease parcels affect surface and groundwater quantity?

An additional 24 issues were identified, considered, and analyzed in brief (AIB) during review of the Proposed Action. These issues are presented in Section 3.5.

Table 1.4 lists resources or concerns that were considered but determined to not warrant analysis in this EA and provides the rationale for the determination.

Table 1.4. Issues Considered but not Analyzed in this EA

Resource or Concern	Rationale for Not Analyzing in EA
Prime or unique farmlands	No prime or unique farmland soils are within the nominated lease parcels; therefore, analysis of potential effects on prime or unique farmlands is not warranted.
Cave/Karst	No known cave or karst resources are within or near the nominated lease parcels; therefore, analysis of potential effects on cave or karst resources is not warranted.
Coal	Federal Coal resources exist on parcels 06-25 and 47. Both parcels have F-27-LN attached. This notice states that operations authorized by this lease may be altered or modified by the authorized officer in order to conserve and protect the mineral resources and provide for simultaneous operations. Further analysis is not warranted.
Lands and realty	Future potential development of the nominated lease parcels would be subject to existing land rights and interests (e.g., easements and water rights). Any potential land use conflicts would be resolved through other processes, such as administrative or legal proceedings, independent from this NEPA review.

CHAPTER 2. PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

Under the Proposed Action, the BLM would offer for lease federal minerals associated with the 16 (14 (March) and two (June), respectively) nominated lease parcels. Table 2.1 includes surface management, the legal land description of the nominated lease parcels totaling 6,179.02 acres, and lease stipulations and notices attached to the parcels. Appendix A contains parcel maps. Appendix B provides a summary of stipulations and lease notices. Under the Proposed Action, the BLM AO has the authority to lease the parcels, or to defer the parcels, based in part on the analysis of potential effects presented in this EA.

Drilling wells on lease parcels is not permitted until the leaseholder submits, and the BLM approves (after additional site-specific environmental review documentation) a complete Application for Permit to Drill (APD) package (Form 3160-3) following the requirements specified in 43 C.F.R. § 3162.3-1 and 43 C.F.R. § 3171. The BLM has authority, according to the standard terms and conditions of the leases, to attach conditions of approval (COAs) to the APD that reduce or avoid impacts to public land, resources, and/or resource values. Under 43 C.F.R. § 3101.12, such reasonable measures may include, but are not limited to, modification to siting or design of facilities, timing of operations, and specification of

interim and final reclamation measures. Measures shall be deemed consistent with lease rights granted provided they do not require relocation of proposed operations by more than 800 meters (m), require that operations be sited off the leasehold, or prohibit new surface-disturbing operations for a period in excess of 90 days in any lease year.

Table 2.1a. FFO March 2019 Competitive Oil and Gas Lease Sale Nominated Lease Parcels

Lease Parcel Number	Surface Ownership	Legal Description	Acres*	Lease Notices and Stipulations†
NM-201903-024	BIA	T.0220N, R.0060W, NM PM, NM Sec. 004 SE; 009 N2; 010 NW; Sandoval County Farmington FO NMNM 76833, NMNM 80480 Formerly Lease No.	640.00	WO-ESA-7 WO-NHPA NM-11-LN NM-1-LN F-15-POD BIA-1 BIA-3 F-39-NSO
NM-201903-025[2]	BIA	T.0220N, R.0060W, NM PM, NM Sec. 005 SW; 006 SE; 008 N2; Sandoval County Farmington FO NMNM 76833 Formerly Lease No.	640.00	WO-ESA-7 WO-NHPA NM-11-LN NM-1-LN F-15-POD BIA-1 BIA-3 F-39-NSO
NM-201903-026	BIA	T.0210N, R.0070W, NM PM, NM Sec. 001 SESE; Sandoval County Farmington FO NMNM 100285 Formerly Lease No.	40.00	WO-ESA-7 WO-NHPA NM-11-LN NM-1-LN F-15-POD BIA-1 BIA-3 F-39-NSO

[2] The March 2019 and June 2019 parcels both have a "Parcel 25". Throughout the analysis, the March 2019 parcel will be referred to as "03-025" while the June 2019 parcel will be referred to as "06-025".

Lease Parcel Number	Surface Ownership	Legal Description	Acres*	Lease Notices and Stipulations†
NM-201903-033	BIA	T.0220N, R.0080W, NM PM, NM Sec. 005 SW; San Juan County Farmington FO Formerly Lease No.	160.00	WO-ESA-7 WO-NHPA NM-11-LN NM-1-LN F-15-POD BIA-1 BIA-3 F-40-CSU
NM-201903-037	BLM	T.0250N, R.0080W, NM PM, NM Sec. 005 SW; San Juan County Farmington FO NMNM 047168 Formerly Lease No.	160.00	WO-ESA-7 WO-NHPA NM-1-LN NM-11-LN F-8-VRM F-15-POD F-40-CSU F-41-LN F-46-CSU
NM-201903-038	BLM / Private	T.0250N, R.0080W, NM PM, NM Sec. 017 W2; San Juan County Farmington FO NMNM 119284 Formerly Lease No.	320.00	WO-ESA-7 WO-NHPA NM-1-LN NM-11-LN F-8-VRM F-15-POD F-40-CSU F-41-LN F-46-CSU
NM-201903-039	BLM	T.0250N, R.0080W, NM PM, NM Sec. 017 W2; San Juan County Farmington FO NMNM 119284 Formerly Lease No.	1,122.85	WO-ESA-7 WO-NHPA NM-1-LN NM-11-LN F-8-VRM F-15-POD F-40-CSU F-41-LN F-46-CSU

Lease Parcel Number	Surface Ownership	Legal Description	Acres*	Lease Notices and Stipulations†
NM-201903-040	BIA	T.0250N, R.0120W, NM PM, NM Sec. 025 N2SE; San Juan County Farmington FO NMNM 112961 Formerly Lease No.	80.00	WO-ESA-7 WO-NHPA NM-11-LN NM-1-LN F-15-POD BIA-1 BIA-3
NM-201903-041	BIA	T.0250N, R.0120W, NM PM, NM Sec. 028 NW; San Juan County Farmington FO NMNM 90483 Formerly Lease No.	160.00	WO-ESA-7 WO-NHPA NM-11-LN NM-1-LN F-15-POD BIA-1 BIA-3
NM-201903-042	BIA	T.0250N, R.0120W, NM PM, NM Sec. 033 SWNW,SW,SWSE; San Juan County Farmington FO NMNM 86493 Formerly Lease No.	240.00	WO-ESA-7 WO-NHPA NM-11-LN NM-1-LN F-15-POD BIA-1 BIA-3
NM-201903-043	BIA	T.0250N, R.0130W, NM PM, NM Sec. 006 LOTS 1-14; 006 S2NE,SE; San Juan County Farmington FO NMNM 114380 Formerly Lease No.	709.29	WO-ESA-7 WO-NHPA NM-11-LN NM-1-LN F-15-POD BIA-1 BIA-3 F-40-CSU

Lease Parcel Number	Surface Ownership	Legal Description	Acres*	Lease Notices and Stipulations†
NM-201903-044	BIA	T.0250N, R.0130W, NM PM, NM Sec. 007 LOTS 1-12; 007 E2; San Juan County Farmington FO NMNM 114380 Formerly Lease No.	712.28	WO-ESA-7 WO-NHPA NM-11-LN NM-1-LN F-15-POD BIA-1 BIA-3 F-40-CSU
NM-201903-045	BIA	T.0250N, R.0130W, NM PM, NM Sec. 018 LOTS 1-12; 018 E2; San Juan County Farmington FO NMNM 114380 Formerly Lease No.	714.60	WO-ESA-7 WO-NHPA NM-11-LN NM-1-LN F-15-POD BIA-1 BIA-3 F-40-CSU
NM-201903-046	BIA	T.0250N, R.0130W, NM PM, NM Sec. 027 NE; San Juan County Farmington FO NMNM 117150 Formerly Lease No.	160.00	WO-ESA-7 WO-NHPA NM-11-LN NM-1-LN F-15-POD BIA-1 BIA-3 F-40-CSU

CSU = controlled surface use; LN = lease notice N = north; NMPM = New Mexico Principal Meridian; NSO = no surface occupancy; R = range; Sec. = section; T = township; W = west

*All acreages contained in the EA analysis were calculated using geographic information system (GIS) data sets for resources and parcels which may differ slightly from the acreages contained in legal descriptions above. Difference in total acres between parcels can vary because of geoprocessing operations where slivers of area are created when two or more data sets intersect. Any inaccuracies are negligible and do not change the overall impact analysis conclusions presented in this EA.

Table 2.2b. FFO June 2019 Competitive Oil and Gas Lease Sale Nominated Lease Parcels

Lease Parcel Number	Surface Ownership	Legal Description	Acres*	Lease Notices and Stipulations†
NM-201906-025	Private	T.0240N, R.0020W, NM PM, NM Sec. 013 NW; Rio Arriba County Farmington FO NMNM 40636 Formerly Lease No.	160	WO-ESA-7 WO-NHPA NM-11-LN F-4-TL F-15-POD F-40-CSU F-41-LN F-8-VRM F-27-LN
NM-201906-047	BLM	T.0240N, R.0070W, NM PM, NM Sec. 033 SW; Rio Arriba County Farmington FO NMNM 127900, NMNM 95617 Formerly Lease No.	160	WO-ESA-7 WO-NHPA NM-11-LN F-4-TL F-15-POD F-40-CSU F-41-LN F-8-VRM F-27-LN

CSU = controlled surface use; LN = lease notice N = north; NMPM = New Mexico Principal Meridian; NSO = no surface occupancy; R = range; Sec. = section; T = township; W = west
*All acreages contained in the EA analysis were calculated using geographic information system (GIS) data sets for resources and parcels which may differ slightly from the acreages contained in legal descriptions above. Difference in total acres between parcels can vary because of geoprocessing operations where slivers of area are created when two or more data sets intersect. Any inaccuracies are negligible and do not change the overall impact analysis conclusions presented in this EA.

2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, the BLM would not offer the nominated parcels for competitive leasing in the March 2019 and/or June 2019 Competitive Oil and Gas Lease Sale; therefore, no parcels would be developed at this time. The parcels would have the potential to be nominated again for a future oil and gas lease sale.

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

3.1 INTRODUCTION

This chapter contains the effects analysis related to the issues listed in Section 1.5.5. Section 3.2 describes the analysis assumptions related to future potential development of the nominated lease parcels. Section 3.3 presents an overview of reasonably foreseeable cumulative actions considered in the effects analysis. Section 3.4 describes the effects of the No Action Alternative for all issues. Section 3.5 presents the issues that are analyzed in brief. Section 3.6 presents the issues that are analyzed in detail.

3.2 ANALYSIS METHODOLOGY

While leasing by itself would not directly authorize any oil and gas development or production, future oil and gas development and production is a reasonable outcome of a granted lease right. Because there are currently no development proposals for the nominated lease parcels, site-specific details are unknown. This analysis conservatively assumes future potential development of the nominated lease parcels would include the development of up to one well per parcel. Sections 3.2.1 and 3.2.2 outline the methodology for estimating the number of wells, potential production volumes, and surface disturbance associated with the future potential development of the nominated lease parcels. Estimates of future potential development are based on known historical data and reasonable assumptions.

3.2.1 Methodology for Estimating Number of Oil and Gas Wells and Production Volumes

Reasonably foreseeable quantitative well development estimates were derived from the well densities identified in *Reasonable Foreseeable Development Scenario for Oil and Gas Activities: Mancos-Gallup RMPA Planning Area, Farmington Field Office, Northwestern New Mexico* (Crocker and Glover 2018; herein incorporated by reference) (hereafter referred to as the "Mancos-Gallup RFD Scenario"). The projected number of wells for each nominated lease parcel is based on the horizontal and vertical well densities (in wells per acre) for each field office, as identified in the Mancos-Gallup Reasonably Foreseeable Development (RFD) Scenario. To calculate the volumes of oil, natural gas, and water expected to be produced from the parcels, the projected number of wells (calculated as described above) was multiplied by the estimated ultimate recoveries (EURs) of oil, natural gas, and produced water per well. These EURs are generated by performing decline curve analyses of existing production within the FFO.

The projected number of wells and associated oil, gas, and produced water production for the nominated lease parcels are summarized in Table 3.1.

Table 3.1. Estimated Well Count and Production for the Nominated Lease Parcels

Sale	Parcel Number	Parcel Acreage*	Field Office	Surface Management	Well Type (Horizonal or Vertical)†	Surface Disturbance (acres)	Oil Production (bbl)	Gas Production (mcf)	Produced Water Production (bbl)
March 2019	NM-201903-024	640.00	FFO	BIA	H	6.85	126,000	1,244,000	70,000
March 2019	NM-201903-025	640.00	FFO	BIA	H	6.85	126,000	1,244,000	70,000
March 2019	NM-201903-026	40.00	FFO	BIA	H	6.85	126,000	1,244,000	70,000
March 2019	NM-201903-033	160.00	FFO	BIA	H	6.85	126,000	1,244,000	70,000
March 2019	NM-201903-037	160.00	FFO	BLM	V	4.35	19,000	3,235,000	140,000
March 2019	NM-201903-038	320.00	FFO	BLM / Private	V	4.35	19,000	3,235,000	140,000
March 2019	NM-201903-039	1,122.85	FFO	BLM	V	4.35	19,000	3,235,000	140,000
March 2019	NM-201903-040	80.00	FFO	BIA	H	6.85	126,000	1,244,000	70,000
March 2019	NM-201903-041	160.00	FFO	BIA	H	6.85	126,000	1,244,000	70,000
March 2019	NM-201903-042	240.00	FFO	BIA	H	6.85	126,000	1,244,000	70,000
March 2019	NM-201903-043	709.29	FFO	BIA	H	6.85	126,000	1,244,000	70,000
March 2019	NM-201903-044	712.28	FFO	BIA	H	6.85	126,000	1,244,000	70,000
March 2019	NM-201903-045	714.60	FFO	BIA	H	6.85	126,000	1,244,000	70,000
March 2019	NM-201903-046	160.00	FFO	BIA	H	6.85	126,000	1,244,000	70,000
June 2019	NM-201906-025	160.00	FFO	Private	H	6.85	126,000	1,244,000	70,000
June 2019	NM-201906-047	160.00	FFO	BLM	H	6.85	126,000	1,244,000	70,000
-	**Total March 2019**		-		**11 H, 3 V**	**88.4**	**1,443,000**	**23,389,000**	**1,190,000**

Sale	Parcel Number	Parcel Acreage*	Field Office	Surface Management	Well Type (Horizonal or Vertical)†	Surface Disturbance (acres)	Oil Production (bbl)	Gas Production (mcf)	Produced Water Production (bbl)
-	**Total June 2019**		-	-	**2 H**	**13.7**	**252,000**	**2,488,000**	**140,000**
-	**Total of Sale Combined**		-	-	**13 H, 3 V**	**102.1**	**1,695,000**	**25,877,000**	**1,330,000**

Note: bbl = barrels; mcf = thousand cubic feet

* All acreages contained in the EA analysis were calculated using geographic information system (GIS) data sets for resources and parcels, which may differ slightly from the acreages contained in the legal description here and in Table 2.1. Difference in total acres between the parcels and acres analyzed in the EA can vary slightly because of geoprocessing operations where slivers of area are created when two or more data sets intersect. Any inaccuracies are negligible and do not change the overall impact analysis conclusions presented in this EA.

† In cases where the methodology used for estimating the number of wells per nominated lease parcel resulted in a fractional value of less than one well per nominated lease parcel (because of low anticipated drilling rate), the fractional value was adjusted upward to the next whole number to represent a rational outcome of the number of potential wells that could be drilled and developed on the nominated lease parcel, as well as to provide meaningful inputs to the oil, gas, and produced water production projections.

3.2.2 Methodology for Estimating Surface Disturbance

It is unknown when, where, or to what extent subsequent well sites, roads, and associated infrastructure would be proposed in the event the BLM decides to lease the nominated lease parcels. Future potential development of the nominated lease parcels could include the following phases (Appendix D provides a summary of the phases of oil and gas development):

- Constructing new access roads or expanding existing roads
- Constructing a well pad
- Drilling a well
- Hydraulically fracturing a well
- Installing pipeline
- Production, including vehicle traffic, hauling of produced fluids such as oil or produced water, compression to move gas through pipeline systems, potential venting from storage tanks, regular well monitoring, and work-over tasks for the life of the well.
- Well plugging and abandonment
- Reclamation and remediation

Based on surface disturbance values identified in the Mancos-Gallup RFD Scenario (Crocker and Glover 2018), supplemented by recent oil and gas development in the BLM FFO, the BLM estimates 6.85 acres of surface disturbance per horizontal well and 4.35 acres of surface disturbance per vertical well. These estimates include surface disturbance associated with the well pads, access roads, and flowlines, and assume two horizontal wells per pad (Crocker and Glover 2018). Assuming future potential development of well type per nominated lease, approximately 102.1 total acres of new surface disturbance is anticipated (see Table 3.1). The March 2019 parcels are expected to result in 88.4 acres of disturbance and June 2019 parcels are expected to result in 13.7 acres of disturbance. Disturbance would remain on the landscape through final abandonment and until the point of final reclamation of facilities, which would be approved and released by the BLM AO (generally assumed to occur after 20 years). Interim/ongoing reclamation procedures would be used to limit impacts by restoring disturbed areas as soon as they are no longer required for operations.

3.3 CUMULATIVE IMPACTS SCENARIO

The BLM FFO encompasses approximately 7.8 million acres within the planning area. This includes 1.4 million acres of BLM surface and 2.4 million acres of federally managed minerals, which are managed by the conditions and decisions of the BLM FFO RMP (BLM 2003). The FFO manages federal surface land and subsurface mineral estates within the four New Mexico counties—San Juan, Rio Arriba, McKinley, and Sandoval—which make up the New Mexico portion of the San Juan Basin (BLM 2015). Within the New Mexico portion of the San Juan Basin, subsurface Mancos shale and Gallup sandstone are the primary target formations (hereafter referred to collectively as the Mancos-Gallup Formation) for developable oil and natural gas resources (Crocker and Glover 2018). The nominated lease parcels are in San Juan, Sandoval and Rio Arriba Counties, overlying the Mancos-Gallup Formation (see Section 3.3.1.1).

The following sections outline the reasonably foreseeable environmental trends and planned actions that are closely related to the Proposed Action and the RFD of the nominated lease parcels. The BLM can identify and disclose reasonably foreseeable environmental trends and planned actions expected to occur over the next 20 years, as this time period is aligned with RMP decisions and the reasonably foreseeable mineral development information available. Since the majority of FFO's federal mineral estate and fluid mineral resources occur within the Mancos-Gallup Formation of the San Juan Basin, related RFD scenarios applicable to this decision are specific to the resources of the Mancos-Gallup Formation. As such, a focused analysis area, henceforth referred to as the Mancos-Gallup Formation Analysis Area (MGFAA) is also considered where applicable, consisting of 4.8 million acres of FFO and Rio Puerco Field Office (RPFO)–managed lands overlaying the Mancos-Gallup Formation (see Section 3.3.1.1).

Additional information related to environmental impacts of current BLM management decisions can be found in the applicable RMPs and environmental impact statement (EIS) (BLM 2003, 2014, 2015). More information related to the environmental trends for air and water resources is available in the *BLM Air Resources Technical Report for Oil and Gas Development in New Mexico, Oklahoma, Texas, and Kansas* (BLM 2023a) and the *BLM Water Support Document for Oil and Gas Development in New Mexico* (BLM 2023b); the BLM acknowledges that these documents are incorporated by reference in this EA.

3.3.1 Energy Development and Other Land Uses

3.3.1.1 *Mineral and Energy Development*

The San Juan Basin has been a producing oil and natural gas field since the early to mid-1900s and is characterized by overlapping uses for oil and gas, grazing, and dispersed recreation. Although most of northwestern New Mexico is in the Colorado Plateau, the San Juan Basin is the dominant feature of the planning area. The San Juan Basin is an asymmetrical syncline that extends from northwestern New Mexico into southwestern Colorado. Roughly circular, it is approximately 200 miles long (north to south) and 130 miles wide, including its Colorado portion, and covers approximately 15,000 to 25,000 square miles.

The MGFAA includes approximately 4.8 million total acres (4.2 million acres and 600,000 acres within the FFO and RPFO planning areas, respectively) of all mineral ownership types in portions of San Juan, Rio Arriba, Sandoval, and McKinley Counties (Crocker and Glover 2018, 2019). Federal oil and gas minerals in the MGFAA cover 2.7 million acres, primarily in the FFO planning area (2.1 million acres)

but also in a small area of the RPFO (500,000 acres)[3] in northwestern Sandoval County (where most of the past and present RPFO-authorized oil and gas development has taken place) (BLM 2003, 2010a, 2012a; Crocker and Glover 2018). Of the federal minerals, approximately 1.9 million acres (70%) are leased (including 1.8 million in FFO and 75,000 in RPFO) and 725,000 acres (27%) are currently unleased (300,000 acres in FFO and 425,000 acres in RPFO) (BLM 2010a; Crocker and Glover 2018). Native American–owned oil and gas minerals (allotted and tribal) cover 1.4 million acres within the FFO planning area, including San Juan, Rio Arriba, Sandoval, and McKinley Counties (Crocker and Glover 2018).

The FFO Mancos-Gallup RFD Scenario (Crocker and Glover 2018) estimates existing long-term surface disturbance across the FFO portion of the MGFAA from oil and gas development to be 56,500 acres (from 37,300 wells). The Mancos-Gallup RFD scenario projects 3,200 new oil and gas wells within the planning area in the 20-year period of 2018 to 2037, the majority of which (2,300 wells) are predicted to be horizontally drilled. New surface disturbance from potential wells in this scenario is estimated at approximately 18,500 acres (Table 3.2). New surface disturbance was estimated at 6.85 acres for each future horizontal well (based on an assumed average of two wells per pad) and 4.35 acres for each future vertical well (Crocker and Glover 2018).

Additionally, the RPFO RFD Scenario (Crocker and Glover 2019) estimates existing long-term surface disturbance within the RPFO administration portion of the MGFAA to be 590 acres (from 919 wells) between 2020 and 2039.[4] The RPFO RFD projects 200 new oil and gas wells will be constructed within the Mancos-Gallup Formation over the 20-year period of 2020 to 2039, the majority of which (160 wells) are predicted to be vertically drilled. New surface disturbance from potential wells in this scenario is estimated to be approximately 2,160 acres (see Table 3.2). New surface disturbance was estimated at 12 acres for each future horizontal well (twinned) and 12 acres for each future vertical well (Crocker and Glover 2019). To date, most of the drilling in the RPFO has occurred in the portion of Sandoval County that is within the MGFAA, and most of the projected future development is expected to occur in this same area (BLM 2023b; Crocker and Glover 2019).

Within consideration of both RFD scenarios within the MGFAA, the total amount of surface disturbance associated with past and planned oil and gas development within the MGFAA is estimated to be 77,750 acres (see Table 3.2). This represents a continued trend of human use of land and mineral resources. Such effects would correspond to the resources present at the location of development with contribution to landscape-level conditions and could result in landscape modifications over time including habitat loss or degradation, changes in plant communities, fluctuating but generally increasing levels of emissions of pollutants, changes in land use patterns and the amount of landscape unaltered by human activities, changes to the visual landscape, and changes in the quantity or quality of water resources. The analyses presented in Sections 3.5 and 3.6 describe the effects of these environmental trends and planned actions related to oil and gas development on resource issues.

3.3.1.2 *Other Mineral and Energy Development*

In addition to oil and gas development, FFO-managed lands provide additional surface and subsurface resources that are used for energy production. The lands also contain saleable and locatable minerals. These resources are associated with the planned actions listed below.

[3] Due to a lack of data concerning the acreage of federal mineral estate within the MGFAA portion of RPFO, this value was based on total federal mineral estate within the Sandoval County portion of RPFO. Therefore, this is likely over estimated since a portion of Sandoval County in RPFO is outside of the MGFAA.

[4] All existing and projected oil and gas development and associated surface disturbance reported in the RPFO RFD (Crocker and Glover 2019) is conservatively assumed to occur within the MGFAA as this area represents the area with the highest development potential for RPFO, and where most historic oil and gas development has occurred.

There are 44,500 acres of active coal leases in the MGFAA (BLM 2012a; BLM and Bureau of Indian Affairs [BIA] 2020). The San Juan underground coal mine, which was previously active in the northwestern portion of the FFO, recently closed in 2022. The surface operation of the San Juan coal mine is currently in reclamation (BLM and BIA 2020). Reclamation activities at the La Plata coal mine (1,650 acres) were completed in 2009 (BHP Billiton 2009). No additional coal leases are expected to be issued for the La Plata or San Juan mines.

The FFO portion of the MGFAA has approximately 245 saleable mineral operations (approximately 27 are in the MGFAA), the majority of which (200) are sandstone pits of less than 5 acres (BLM and BIA 2020). Large commercial sand and gravel operations and humate operations make up the remainder. It is unknown if the RPFO portion of the MGFAA contains any active mineral operations; however, mineral operations for sand, gravel, and baked shale are common in Sandoval County and may occur within the MGFAA both currently and in the future (BLM 2012a). Eight saleable minerals operations in the FFO portion of the MGFAA are currently pending permits (BLM and BIA 2020). Saleable mineral activity is expected to continue.

Nearly 18,000 BLM-issued rights-of-way are in the MGFAA for facilities such as water lines, transmission lines, roads, communication sites, or pipelines (BLM 2009; BLM and BIA 2020). The planning area includes portions of the Navajo-Gallup Water Supply Project, which is projected to deliver water to more than 43 Navajo chapters through a 280-mile-long pipeline and two water treatment plants (Bureau of Reclamation 2018).

Energy generation uses are focused on specific locations near the communities of Aztec, Blanco, Bloomfield, Counselor, Farmington, Gobernador, Kirtland, Lindrith, and Nageezi. There is some potential for future renewable energy development (i.e., wind and solar) within the MGFAA; there are currently three active applications for solar projects within the MGFAA including one on BLM-managed land and two on private land (BLM and BIA 2020).

Energy generation and mineral development on federal lands or mineral estate is expected to continue under the management and conditions outlined in the FFO and RPFO RMPs (BLM 2003, 2024). This represents a continued trend of human use of land and mineral resources. Such effects would correspond to the resources present at the location of development with contribution to landscape-level conditions and could result in landscape modifications overtime including habitat loss or degradation, changes in plant communities, fluctuating but generally increasing levels of emissions of pollutants, changes in land use patterns and the amount of landscape unaltered by human activities, changes to the visual landscape, and changes in the quantity or quality of water resources. The analyses presented in Sections 3.5 and 3.6 describe the effects of these environmental trends and planned actions closely related to oil and gas development on resource issues.

3.3.1.3 *Municipal and Other Land Uses*

Based on trends of past and present activity, it can be expected that MGFAA lands would continue to be used at current or slightly increased levels for municipal and other land uses such as urban development, agriculture, and grazing. Urban development is focused near the communities of Aztec, Blanco, Bloomfield, Counselor, Farmington, Gobernador, Kirtland, Lindrith, and Nageezi. Future expansion is expected in Farmington, Aztec, and Bloomfield, including development for roads, utilities, and communication lines. Future expansion of utilities, public spaces, roads, and residential areas is expected within Navajo Nation lands managed by the Counselor Chapter House jurisdiction. Additionally, agricultural use is present along the Animas and San Juan Rivers; south of the Farmington-Aztec-Bloomfield tri-city area, the Navajo Indian Irrigation Project currently irrigates approximately 64,000 acres of agricultural land (BLM 2015). Within the FFO portion of the MGFAA, 208 proximal

grazing allotments also collectively cover approximately 1.4 million acres of BLM managed lands (BLM and BIA 2020). Grazing also occurs within the RPFO in Sandoval County, but it is unknown how many grazing allotments or acres of grazing intersect the MGFAA. The BLM anticipates grazing to continue at the current rates.

Such effects would correspond to the resources present at the specific development location with contribution to landscape-level conditions and could result in landscape modifications over time including habitat loss or degradation, changes in plant communities, fluctuating but generally increasing levels of emissions of pollutants, changes in land use patterns and the amount of landscape unaltered by human activities, changes to the visual landscape, and changes in the quantity or quality of water resources. The analyses presented in Sections 3.5 and 3.6 describe the effects of these environmental trends and planned actions related to oil and gas development on resource issues.

3.3.1.4 *Quantification of Landscape Disturbance*

Table 3.2 summarizes the estimated acreage of landscape disturbance associated with energy and mineral development as well as other land uses within the MGFAA. The information provided in Table 3.2 presents a quantification of past and planned actions that are associated with surface disturbance and the correlated contribution to effects and environmental trends described above. Approximately 131,590 acres (2.7%) of the MGFAA (4.8 million acres) have been previously disturbed by energy and mineral development as well as other land uses. Future planned actions are estimated to result in an additional 25,660 acres (0.53%) of disturbance within the MGFAA, for a combined total of 157,250 acres (3.3%) of surface disturbance. Table 3.3 presents a quantification of the relative contribution of the Proposed Action to the landscape disturbance associated with existing environmental trends and planned actions.

Additional information related to environmental impacts of current BLM management decisions can be found in the applicable RMPs and EISs (BLM 2003, 2014, 2015). More information related to air and water resources environmental trends is also available in the *BLM Air Resources Technical Report for Oil and Gas Development in New Mexico, Oklahoma, Texas, and Kansas* (BLM 2023a) and the *BLM Water Support Document for Oil and Gas Development in New Mexico* (BLM 2023b); the BLM acknowledges that these documents are incorporated by reference in this EA.

Table 3.2. Estimated Landscape Disturbance Associated with Cumulative Actions within the FFO

Analysis Areas		**Acreage**
FFO planning area		7,828,509
Mancos-Gallup Formation analysis area*		4,800,000
Disturbance Trends within Mancos Gallup Formation Analysis Area	**Number of Wells**	**Acreage**
Other development and surface use (mining, grazing, roads, transmission lines, and urban expansion)	–	74,500†
FFO existing oil and gas disturbance (construction of oil and gas well pads and associated access roads and pipeline infrastructure)	37,300	56,500
RPFO existing oil and gas disturbance (construction of oil and gas well pads and associated access roads and pipeline infrastructure)	919	590
Subtotal past and present surface use (disturbance)	*38,219*	*131,590*
Other development and surface use	–	5,000
Mancos-Gallup RFD (2018–2037)	3,200	18,500

RPFO RFD (2020–2039)	200	2,160
Subtotal planned actions	*3,400*	*25,660*
Total estimated landscape disturbance	**41,619**	**157,250**
Total contribution of the Proposed Action to planned actions	16 (0.47% of planned wells)	102.1 (0.40% of planned landscape disturbance)
Contribution of the March 2019 parcels portion Proposed Action to planned actions	14 (0.41% of planned wells)	88.4 (.34% of planned landscape disturbance)
Contribution of the June 2019 parcels portion Proposed Action to planned actions	2 (0.06% of planned wells)	13.7 (.05% of planned landscape disturbance)
Total contribution of the Proposed Action to total estimated landscape disturbance within the MGFAA	0.04% of total existing and planned wells	0.06% of total existing and planned landscape disturbance
Contribution of the March 2019 parcels Proposed Action to total estimated landscape disturbance within the MGFAA	0.03% of total existing and planned wells	0.06% of total existing and planned landscape disturbance
Contribution of the June 2019 parcels Proposed Action to total estimated landscape disturbance within the MGFAA	0.005% of total existing and planned wells	0.009% of total existing and planned landscape disturbance

*Mancos-Gallup Formation analysis area encompasses land overlaying the Mancos-Gallup Formation of the San Juan Basin within San Juan, Rio Arriba, McKinley, and Sandoval Counties. To account for variability in data sources, this analysis assumes that all disclosed planned action surface disturbance would occur within the MGFAA. BLM acknowledges this is likely an overestimate of MGFAA-specific reasonably foreseeable environmental trends and planned actions as land uses such as other development and urban expansion may occur within the FFO, but outside the MGFAA.

†This number is likely an underestimate of total non-oil and gas–related disturbance in the analysis area. No study calculating existing disturbance for the analysis area was available at the time of writing. This value was estimated based on acreages reported in the Mancos-Gallup RMP Amendment and EIS, Assessment of the Management Situation (BLM 2015).

Table 3.3 Contribution of Proposed Action to Landscape Disturbance

	Contribution of the Proposed Action (16 wells, 102.1 acres of surface disturbance)	
Analysis Area/Metric (number of wells, acres of surface disturbance)	**Wells (percentage)**	**Surface Disturbance (percentage)**
FFO planning area (7,828,509 acres)	NA	0.0013%
RPFO portion of MGFAA (500,000 acres*)	NA	0.02%
MGFAA (4,800,000)	NA	0.002%
Planned actions within MGFAA (3,400 wells; 25,660 acres)	0.47%	0.40%
Total estimated landscape disturbance within MGFAA (41,619 wells; 157,250 acres)	0.04%	0.06%

Note: NA = not applicable

*The entire RPFO planning area is 9,500,000 acres.

3.3.2 Land Restoration and Conservation Activities

A multifaceted network of federal and state agencies and non-governmental organizations reclaim, restore, and conserve land and resources in the FFO. The BLM New Mexico State Office (NMSO) has partnered with the State of New Mexico, ranchers, industry, and other local partners on a restoration initiative called Restore New Mexico. Since 2005, the initiative has treated over 3 million acres of grasslands, woodlands, and riparian areas across the state that had been degraded by invasive species and

woodland encroachment in New Mexico (U.S. Geological Survey [USGS] 2019). This program has also resulted in the reclamation of some oil and gas legacy well pads, and roads within the analysis area (USGS 2019). Restore New Mexico's rehabilitation efforts and continued work are considered an ongoing countervailing effect on present and future landscape-level surface disturbance as legacy oil and gas development and ecosystems are gradually restored.

Clover's cactus (*Sclerocactus cloverae*) and Aztec gilia (*Aliciella formosa*) are two BLM sensitive plant species that occur within the FFO planning area. Habitat for these two species is managed in accordance with IM No. NM IM-F01210-2017-003, which provides guidance for managing ground-disturbing projects on BLM-managed lands (BLM 2017). The IM prescribes proactive conservation measures to conserve habitat and maintain the viability of both species, such as requirements for pre-disturbance surveys and plans, moving projects outside of suitable habitat, and incorporating avoidance and minimization measures. All planned actions involving ground disturbance on BLM-managed lands would be subject to the requirements of this IM, as revised.

The *Crow Mesa Habitat Management Plan* (BLM 1999) provides guidance in the management of approximately 43,000 acres of BLM and New Mexico State trust lands, which provide habitat for resident mule deer, elk, and other wildlife species. The primary objective of this plan is to improve forage and other habitat features for wildlife species. Habitat improvement projects prescribed in the plan include prescribed burning, seeding, herbicide treatments, installation of water sources, fence modifications, and road removal. The BLM has also funded many of these projects through its annual budget.

The New Mexico Habitat Stamp Program (HSP), adopted by the New Mexico State Game Commission in 1991, was created to plan, develop, maintain, and coordinate conservation and rehabilitation programs that are designed to have a positive impact to wildlife and fish populations. Funding for projects implemented through the HSP comes from sale of a $5.00 stamp or authorization associated with hunting and fishing licenses. Examples of the types of projects that could be performed with HSP funds include reclamation of roads that are no longer needed; removing unnecessary infrastructure from the landscape, riparian and upland plantings and enclosures; seeding; thinning; prescribed burning; developing wildlife watering facilities; and modifying fences to accommodate wildlife movement (NMDGF et al. 2017).

The BLM is working with the State of New Mexico to enhance and improve the quality of big-game winter range and migration corridor habitat on federal lands. One of the primary obstacles in managing big game corridors in New Mexico is the lack of GPS collar data (NMDGF 2019). Wildlife corridors have been identified by local BLM biologists and supported by mule deer migration studies using telemetry collars in Rosa Mesa (BLM and BIA 2020). Habitat and mitigation projects that are identified as priorities for the San Juan basin landscape in the 2015 New Mexico State Action Plan for Secretarial Order 3362 (NMDGF 2019) include habitat enhancement within the mapped migration corridor and along exterior/fringe routes, limiting pinyon and juniper encroachment, improving browse availability and access within the corridors and on winter range, reseeding native forbs and grasses in disturbed areas, minimizing feral horse access and impacts to the seasonal range and migration corridors, modifying fences along the migration corridor to make them wildlife friendly and to facilitate movement, implementing mitigation actions to reduce wildlife-vehicle collisions at high-risk areas, and limiting surface disturbance, including restricting the timing of activities (NMDGF 2019).

Chemical and physical vegetation treatments have been implemented in the planning area since the 1950s. The sagebrush community has undergone the majority of treatments, particularly with herbicide to thin sagebrush density, since the 1990s (BLM and BIA 2020). The FFO currently manages weed infestations through integrated weed management, including biological, chemical, mechanical, manual, and educational methods, primarily through weed control cooperative range improvement agreements

(BLM and BIA 2020). A Fire Management Plan is currently being developed for the FFO, and vegetation management projects (e.g., prescribed burns) are planned at site-specific levels (BLM and BIA 2020).

It is anticipated that the BLM and other agencies would continue to treat lands within the FFO with prescribed fire, mechanical treatments, and herbicide according to the FFO RMP (BLM 2003) and other management plans described above. New habitat conservation plans could be developed for listed species, or if additional species are listed as threatened or endangered in the future. Ongoing land restoration and conservation actions are expected to have effects on landscape-level conditions and could result in landscape modifications over time, including habitat improvements, changes in plant communities, and reclamation of disturbed lands. The analyses presented in Sections 3.5 and 3.6 describe the effects of these environmental trends and planned actions related to oil and gas development on resource issues.

3.3.3 Changes to Regional Environmental Conditions Related to Climate Change

Climate change, further discussed in Section 3.6.2, is a global process that is impacted by the total amount of GHGs in the Earth's atmosphere. Currently, global climate models are unable to forecast local or regional effects on resources (Intergovernmental Panel on Climate Change [IPCC] 2013). However, general projections regarding potential impacts to natural resources and plant and animal species may be attributable to climate change from GHG emissions over time. These effects are likely to be varied, including those in the southwestern United States (Karl et al. 2009). Climate models project robust differences in regional changes related to precipitation patterns, average temperatures, and the frequency or severity of drought (IPCC 2013). Impacts of climate change to regionally variable ecosystem processes have also been observed and have been used to make general projections regarding potential future effects of climate change on natural resources and plant and animal species for different regions (Karl et al. 2009).

The FFO planning area is included in the Upper Rio Grande Basin (south Colorado to south-central New Mexico), which is expected to be affected in both the short and long term by variations in global and regional environmental conditions related to climate change. There have been observable trends in warming temperatures for New Mexico in which average annual temperatures have increased by almost 2 degrees Fahrenheit, since the beginning of the twentieth century, and the number of extremely hot days, warm nights, and extreme heat events have also increased. Droughts are a serious threat in water-scarce New Mexico and wildfire frequency and severity are projected to increase. The summer monsoon rainfall, which provides much needed water for agricultural and ecological systems, varies greatly from year to year and future trends in such precipitation are highly uncertain (BLM 2023b). Additional information related to global, regional, and state climate change projections can be found in the Air Resources Technical Report (BLM 2023a) and the *2022 BLM Specialist Report on Annual Greenhouse Gas Emissions and Climate Trends* (referred to herein as Annual GHG Report [BLM 2023c]). Lastly, information on climate impacts to ecoregions within the nominated lease parcels (see AIB-5) can be found in the USGS *Southern Great Plains Rapid Ecoregional Assessment – Volume I. Ecological communities* (Reese et al. 2017; incorporated by reference).

3.4 NO ACTION ALTERNATIVE FOR ALL ISSUES

Under the No Action Alternative, the BLM would not offer the nominated parcels for competitive leasing in the March 2019 and June 2019 Competitive Oil and Gas Lease Sales; therefore, no parcels would be developed at this time. The parcels would have the potential to be nominated again for a future oil and gas lease sale.

3.5 ISSUES ANALYZED IN BRIEF

Following internal and external scoping, 24 issues were identified, considered, and analyzed in brief by members of the IDT in review of the Proposed Action. Each of these issues is outlined below with a concise discussion regarding the context and intensity of the impact related to each issue. Stipulations WO-ESA, WO-NHPA, F-15-POD, and Lease Notices NM-11-LN, as well as standard terms and conditions as described in the lease form, would apply to all nominated lease parcels. For all AIB issues that follow, it is assumed that the effects of reasonably foreseeable cumulative actions to relevant elements of the environment would be consistent with the landscape disturbance acreages presented in Table 3.2.

For this analysis, short-term effects are considered those that cease after well construction and completion (30–60 days) or cease after interim reclamation (2–5 years). Long-term effects are considered to be those associated with operation and production activities over the life of the well (for example, noise) or that otherwise extend beyond the short-term time period (for example, surface disturbance subject to final reclamation). As such, some long-term effects would cease immediately upon the end of operations, whereas other long-term effects would remain until successful landscape reclamation is accomplished. Note that the time frame for successful reclamation would vary by vegetation type and other factors such as the amount and timing of annual precipitation (see AIB-5 for more information).

AIB-1 Groundwater Quality

How would future potential development of the nominated lease parcels affect groundwater quality?

Leasing and future potential development of the nominated lease parcels would result in oil and gas activities, including well pad construction, drilling, and completion of an estimated seven vertical wells. The wells would employ standard industry practices related to well completion (i.e., perforation and hydraulic fracturing). Types of chemical additives used in well completion activities may include acids, hydrocarbons, thickening agents, gelling agents, lubricants, and other additives that are operator- and location-specific. The largest components in hydraulic fracturing fluid are water and sand.

Reasonably foreseeable well development associated with the RFD scenario (see Section 3.3) would most likely pass through a usable groundwater aquifer currently or potentially supplying stock, residential, and/or irrigation water. If proper cementing and casing programs are not followed, there may be a loss of well integrity, surface spills, or loss of fluids in the drilling and completion process that may result in large volumes of high concentrations of chemicals reaching groundwater resources. If contamination of usable water aquifers (resulting in total dissolved solids [TDS] greater than 10,000 parts per million [ppm]) from any source occurs, springs and water wells that are sourced from the affected aquifers could be subject to long-term decreases in water quality depending on the severity of the contamination event. According to New Mexico Administrative Code (NMAC) 19.15.16, operators are required to seal and isolate strata containing fresh water from oil and gas–bearing strata (including sealing the annulus). BLM regulations (including those covered under 43 C.F.R. § 3160, 43 C.F.R. § 3162.3-3, 43 C.F.R. § 3162.3-5, 43 C.F.R. § 3171, 43 C.F.R. § 3172, and 43 C.F.R. § 3177), New Mexico Oil Conservation Division (NMOCD) regulations (NMAC 19.15.26), and the state's primacy agreement under the federal Safe Drinking Water Act include requirements for hydraulic fracturing such as casing specifications, monitoring and recording, and management of recovered fluids (wastewater or produced water). The BLM and state of NM enforce these safeguards, which have been put in place to prevent these situations from occurring.

The *2023 BLM Water Support Document for Oil and Gas Development in New Mexico* (BLM 2023b) (hereafter referred to as the Water Support Document and incorporated by reference) contains a detailed summary of the regulatory program associated with hydraulic fracturing and measures to protect groundwater quality. A list of the potential environmental effects of hydraulic fracturing can be found in the U.S. Environmental Protection Agency (EPA) report, *Hydraulic Fracturing for Oil and Gas: Impacts from the Hydraulic Fracturing Water Cycle on Drinking Water Resources in the United States* (EPA 2016). In summary, this report examines six different scenarios in which drinking water resources may be affected by hydraulic fracturing: 1) water withdrawals during periods of low water availability, 2) spills of hydraulic fracturing fluids/chemicals and/or produced water, 3) release of hydraulic fracturing fluids from wells with inadequate casing, 4) direct injection of hydraulic fracturing fluids into groundwater, 5) discharge of insufficiently treated wastewater to surface water, and 6) contamination of groundwater from unlined storage/disposal pits.

Per- and polyfluoroalkyl substances (PFAS), which is a broad term classification for a large group of human-made chemicals that are found in a wide variety of industrial processes and common household items. PFAS are a main component of aqueous film-forming foam, which is used regularly in fire suppression and prevention activities performed at airports and military bases. Aqueous film-forming foam is a major source of PFAS groundwater contamination and has been recognized as a nationally significant challenge in the United States (Sunderland et al. 2018). PFAS are very persistent in both the environment and the human body due to their inability to readily break down (U.S. Environmental Protection Agency [EPA] 2024e). PFAS persistence has been linked to bioaccumulation in both the environment and human body, which may lead to adverse effects on human health (EPA 2024e). In the years 2020–2021, the USGS partnered with the NMED to conduct a statewide assessment on PFAS to better understand PFAS contamination throughout the state (USGS 2024). The study analyzed PFAS presence in groundwater across New Mexico. Of the 117 groundwater sample locations across New Mexico, 27 sample locations (23% of sampling locations) were found to have one or more PFAS above the laboratory detection limit (USGS 2024). There were no PFAS sample locations that had concentrations exceeding the EPA's 70 nanogram/liter recommendation (USGS 2024).

PFAS may be used during the hydraulic fracturing process due to their stability at high temperatures and pressures and may be used in well drilling (in the form of drilling fluids), well completion, and workover operations (Gaines 2022). In addition to drilling efficiency purposes, PFAS are used as an effective method to mitigate oil spills in water. Use of PFAS chemicals makes up a minimal amount (less than 1%) of chemical constituents disclosed to FracFocus for hydraulic fracturing in New Mexico (FracFocus 2024). In total, 63 of the approximately 31,000 ingredient disclosures (0.01%) in 2023 were related to PFAS used in hydraulic fracturing processes in New Mexico. PFAS use in hydraulic fracturing is likely to occur in areas not associated with New Mexico's drinking water.

Of the 3,400 wells identified in the RFD scenario, sixteen wells (0.47% of the FFO Mancos-Gallup RFD scenarios) would be attributable to future potential development of the nominated lease parcels (see Section 3.3). The future potential development of nominated lease parcels (102.1 acres) would comprise 0.06% of the total landscape-level surface disturbance trends (157,250 acres) (see Table 3.2) identified in Section 3.3.

The sixteen nominated lease parcels are within the San Juan 1976 Basin aquifer (New Mexico Office of the State Engineer [NMOSE] 2023). The nominated lease parcels' acreages (6,179.02 acres) compromise 0.01% of the total San Juan groundwater basin acreage (6.2 million acres). Freshwater in the groundwater basin is typically found where it is confined at depths less than 2,500 feet below the ground surface with saline and brackish water dominant at deeper depths (BLM and BIA 2020). The Mancos Shale formation is approximately 2,500 feet deep and the average oil and/or gas well depth within the respective counties are 4,473 feet (San Juan County), 5,889 feet (Rio Arriba County), 5,600 feet (Sandoval County) (Mineral

Answers 2022). Based on the estimated aquifer thickness and depth within the analysis area, future potential development of the nominated lease parcels would likely result in a well drilled beyond (deeper than) the regional aquifers, and below any underground sources of drinking water. Whereas a well drilled would likely pass through these aquifers, the evidence indicates that the regulatory programs described previously would be protective of these water resources.Nominated lease parcel 06-25 contains a groundwater well (livestock watering). There are no parcels that have groundwater wells within 200 m (656 feet).

Standard terms and conditions would apply to all leases, which allows for siting of wells to minimize potential impacts to existing groundwater wells and groundwater resources. See AIB-12 for more information regarding livestock wells and range improvements.

Protection of groundwater is enforced in concert with the State of New Mexico and any other applicable entities with jurisdiction (e.g., tribal entities or the EPA), and mitigation of any water-contaminating event would occur in addition to the enforcement of applicable regulations. If effects were to occur, lessees and operators would be obligated by the standard terms of the lease, as well as the approved APD and applicable BLM and NMOCD regulations, to report, respond to, and mitigate the spill or release. Additionally, all injection wells permitted by the NMOCD (including injection wells and producing wells and all related surface facilities) are subject to a surface injection pressure limitation. Wells are required to be equipped with a pressure-limiting device, which ensures that the maximum surface injection pressure is not exceeded (NMOCD 2004). BLM District Office inspection and enforcement personnel periodically inspect wells and surface facilities to ensure that all wells and related surface facilities are in good repair and leak free (NMOCD 2004). The NMOCD is also responsible for oversight of hydraulic fracturing wastewater pits. NMAC 19.15.17 regulates the use of liners as well as depth restrictions to protect groundwater resources.

Spill occurrences could affect groundwater on-site or during material transport. The Water Support Document (BLM 2023b) notes there were 943 spills in the New Mexico portion of the San Juan Basin in 2022. The rate and ability for spill recovery varies by spill type, but in 2022 the average loss rate for all liquid spill types was approximately 99%. Spills that are not recovered are remediated, which may include removal of contaminated soil. However, in 2022 no spills occurring in the San Juan Basin were reported as having affected groundwater (BLM 2023b). Should a spill occur, the BLM would work with the NMOCD to immediately remediate spills on BLM lands in accordance with federal and state standards, including NMAC 19.15.29.11. According to NMAC 19.15.29.11, the operator shall complete division-approved corrective actions for releases that endanger public health or the environment in accordance with a remediation plan submitted to and approved by the division or with an abatement plan submitted in accordance with NMAC 19.15.30. The remaining contaminates from unrecovered spills are remediated in accordance with federal and state standards. Such remediation could consist of removal of contaminated soil, replacement with uncontaminated soil, and subsequent chemical testing. See the Water Support Document (BLM 2023b) for further information on spills.

In summary, the BLM, New Mexico Environment Department (NMED), and the NMOCD have put in place numerous requirements for oil and gas producers so that drilling fluids, hydraulic fracturing fluids, and produced water and hydrocarbons remain within the well bore and do not enter groundwater or any other formations. These include BLM regulations covered under 43 C.F.R. § 3160; 43 C.F.R. § 3162.3-3; 43 C.F.R. § 3162.3-5; 43 C.F.R. § 3171; 43 C.F.R. § 3172; 43 C.F.R. § 3177; Notice to Lessees 3A; NMOCD regulations under NMAC 19.15.26; and the state's primacy agreement under the Safe Drinking Water Act. With these requirements in place, including the use of casing and cementing measures, contamination of groundwater resources from the nominated lease parcels is highly unlikely. In addition, the BLM has authority under standard terms and conditions to require additional measures to protect water quality if site-specific circumstances require them. Site-specific mitigation tools would be

developed as appropriate for individual circumstances, including groundwater-quality monitoring studies. The BLM regulations at 43 C.F.R. § 3162.5-2(d) give the BLM the authority to require an operator to monitor water resources to ensure that the isolation procedures used to protect water and other resources are effective.

AIB-2 Surface Water Quality

How would future potential development of the nominated lease parcels affect watershed hydrology and surface water quality?

The MGFAA encompasses eight watersheds, as mapped by the USGS 8-digit hydrologic unit codes (HUCs). Within the 4.8 million-acre MGFAA, existing surface disturbance associated with past and present activities is estimated to be 131,590 acres (see Table 3.2), which comprises approximately 2.7% of the MGFAA and 1.7% of the FFO.

Reasonably foreseeable environmental trends and planned actions within the MGFAA are estimated to result in approximately 25,660 acres of new surface disturbance, which represents 0.33% of the approximately 7.8 million-acre FFO and 0.53% of the 4.8 million-acre MGFAA. These actions would disturb vegetation, soils, and mineral substrate, which would create dust and increase runoff rates during precipitation events. By increasing runoff and removing vegetation, disturbed areas would become more susceptible to erosion. Soil that is carried downgradient by runoff because of upslope erosion may create sedimentation issues in streams. Sedimentation would be most likely to occur during construction of stream crossings for access roads and flowlines, and at disturbances nearest streams; however, effects would remain until disturbed areas are restored to preconstruction conditions. Development of the RFD scenario also carries a risk of spills that could result in the delivery of contaminants to surface water depending on the proximity of development activities to surface water and the measures applied to address the possibility of spills reaching surface water bodies. However, as noted in the Water Support Document (BLM 2023b), 11 of the 943 spills in 2022 (1.17%) in the San Juan Basin were reported as having affected surface water.

Table 3.4. Parcels and associated HUC-10 Watersheds

Parcels	HUC-10 Watershed (HUC ID) – Size of Watershed (acres)
040 (100%) 041 (100%) 042 (100%) 043 (47%) 044 (63%) 045 (63%) 046 (100%)	Hunter Wash (1408010614) - 122,170.53
043 (53%) 044 (37%) 045 (37%)	Sanostee Wash-Chaco River (ID: 1408010618) - 205,500.5
024 (100%) 03-025 (42%)	Headwaters Canon Largo (ID: 1408010301) - 181,073.68
06-025 (100%)	Canada Larga (ID: 1408010302) - 189,970.66
037 (100%) 038 (100%) 039 (100%) 047 (16%)	Blanco Canyon (ID: 1408010305) - 169,788.37
047 (84%)	Outlet Canon Largo (ID: 1408010306) - 235,378.41

03-025 (58%) 026 (100%)	Canada Alemita-Chaco Wash (ID: 1408010601) - 212,239.9
033 (100%)	Escavada Wash (ID: 1408010603) - 147,177.05

The nominated lease parcels do not contain any Clean Water Act 303(d) impaired waters. Future potential development of the nominated lease parcels would result in approximately 102.1 acres of surface disturbance (approximately 1.65% of the total nominated lease parcel acreage). This surface disturbance would result in long-term disturbance to vegetation, soils, and mineral substrate, which in turn would increase the potential for dust, runoff, salination, and sedimentation of nearby water bodies. Future potential development of the lease parcels would also result in a small, albeit present, risk of spills. For detailed discussion of the risk of spills associated with oil and gas development, see Section 3.2 of the Water Support Document (BLM 2023b).

Based on review of the USGS's National Hydrography Dataset (NHD) and the USFWS's National Wetlands Inventory (NWI) dataset,[5] surface water features are present on 13 nominated lease parcels. Table 3.5 lists the previously mapped surface water features that are present within the nominated lease parcels.

Table 3.5. Surface Water Feature Impact Summary

Parcel (total parcel acreage)	**Water Features Present in Parcel***
024 (640)	Intermittent streams/rivers (1.09 miles); artificial path (0.01 mile); perennial lake/pond (0.37 acre); riverine wetland (1.74 acres); freshwater emergent wetland (0.26 acre); freshwater pond (0.56 acre)
03-025 (640)	Intermittent streams/rivers (0.86 mile); riverine wetland (3 acres); freshwater emergent wetland (0.16 acre); freshwater pond (0.05 acre)
026 (40)	Intermittent streams/rivers (0.02 mile); riverine wetland (0.06 acre)
033 (160)	Intermittent streams/rivers (0.37 mile); riverine wetland (0.64 acre)
037 (160)	Intermittent streams/rivers (0.64 mile); riverine wetland (0.21 acres). FEMA Zone A Floodplain[6] (30.29 acres)
038 (320)	Intermittent streams/rivers (1.89 miles); riverine wetland (9.71 acres); freshwater pond (0.81 acre); FEMA Zone A Floodplain (66.16 acres)
039 (1,122.85)	Intermittent streams/rivers (3.59 miles); artificial path (0.02 mile); intermittent lake/pond (0.31 acre); riverine wetland (26.65 acre); freshwater emergent wetland (0.52 acre); freshwater pond (0.69 acre); FEMA Zone A Floodplain (160.01 acres)
040 (80)	Intermittent streams/rivers (0.02 mile)
041 (160)	Intermittent streams/rivers (0.35 mile); riverine wetland (0.35 acre)
042 (240)	Intermittent streams/rivers (2.26 miles); riverine wetland (5.08 acres); FEMA Zone A Floodplain (16.17 acres)
043 (709.29)	There are no water features present in the parcel.
044 (712.28)	There are no water features present in the parcel.

[5] Delineation size of surface water features varies between the NHD and NWI data sets. Site-specific analysis of the nominated lease parcels would identify aquatic features and wetlands at the time of future potential development of the nominated lease parcels.

[6] NHD and NWI data, in some instances, overlap and therefore the acreages presented in the table may be overestimates.

Parcel (total parcel acreage)	Water Features Present in Parcel*
045 (714.6)	Intermittent streams/rivers (0.53 mile); intermittent lake/pond (0.45 acre); riverine wetland (1.28 acres); freshwater pond (0.45 acre)
046 (160)	There are no water features present in the parcel.
06-025 (160)	Intermittent streams/rivers (0.93 mile); artificial path (0.02 acre); intermittent lake/pond (0.26 acre); riverine wetland (1.09 acres); freshwater pond (0.47 acre)
047 (160)	Intermittent streams/rivers (0.45 mile); riverine wetland (1.02 acres)

Note: See Appendix B for summaries of stipulations and lease notices.

Previously mapped surface water features have been identified based on analysis of the USGS's NHD and the USFWS's NWI dataset. Additional surface water features may be identified during site-specific analysis at the lease development stage, and the lessee would be required to follow applicable standard terms and conditions, as well as COAs determined by the BLM.

CSU = controlled surface use; FEMA = Federal Emergency Management Agency

* Wetlands may overlap or surround other surface water features depending on site-specific delineation; therefore, acreage of wetlands may be included in other surface water features presented in this table.

† Artificial paths are used to complete the stream network through NHD waterbodies and NHD areas where there is no obvious channel. Isolated NHD waterbody features may not contain artificial paths.

‡ FEMA defines zone A floodplains as 100-year floodplains that have a 1% change of being inundated in a given year.

The surface water features listed in Table 3.5 comprise approximately 0% to ~24% of the total acreage for each of the lease sale parcels. Given that the footprint of future potential development would comprise approximately 1.65% of the total nominated lease parcel acreage, mapped surface water features could reasonably be avoided through the application of standard terms and conditions. The ability to avoid these features would reduce the potential for impacts to watershed hydrology and surface waters. In addition, the BLM's authority under standard lease terms and conditions allows for the application of measures to avoid and mitigate accelerated soil erosion and sedimentation to water bodies. These measures include but are not limited to BLM Gold Book standards, Onshore Orders, Operators Surface Use Plan of Operations, and COAs.

For further information on measures that may be required, such as casing, cementing, or remediation that could consist of removing contaminated soil, replacing it with uncontaminated soil, and performing corresponding chemical testing, see the Water Support Document (BLM 2023b). The NMOCD expressly prohibits pollution of any surface or subsurface fresh water from well completion activities, or treatment, transportation, and disposal of produced water, and provides management of hydraulic fracturing operations. Finally, NMAC 19.15.16 contains minimum casing and cementing standards. Site-specific mitigation tools would be developed as appropriate for individual circumstances and could include surface water monitoring studies. For example, if hydraulic fracturing was to occur in an area that had potential to connect to water resources, NMAC regulations would apply to ensure that water is not contaminated during the process by requiring the operator to test the water resource before, during, and after operations.

The BLM's authority to require additional protective measures, and the low level of surface disturbance relative to the total watersheds would all serve to minimize the risk of effects on watershed hydrology and surface water quality. Should a spill occur, the BLM would work with the NMOCD to immediately remediate the spills in accordance with federal and state standards, including NMAC 19.15.29.11. Under NMAC 19.15.29.11, the responsible person shall complete division-approved corrective action for releases that endanger public health or the environment in accordance with a remediation plan submitted to and approved by the division or with an abatement plan compliant with NMAC 19.15.30.
The remaining contaminates from unrecovered spills are remediated in accordance with federal and state standards. Some remediation consists of removal of contaminated soil, replacement with uncontaminated soil, and subsequent chemical testing. See the Water Support Document (BLM 2023b) for further

information on spills. Additionally, as groundwater is mostly used for oil and gas operations, surface water quantity is not expected to be impacted (see Issue 3 in Section 3.6.3).

AIB-3 Induced Seismicity

How would future potential development of the nominated lease parcels affect the potential for induced seismicity in the FFO?

Induced seismicity refers to seismic events that are triggered by human activities rather than natural tectonic forces. A broad range of human activities have been attributed to induced seismicity, including but not limited to underground fluid injection (e.g., for wastewater and hydraulic fracturing) and oil and gas extraction (Groundwater Protection Council [GWPC] 2021). Between 2008 and 2015, seismicity events increased in the mid-continental United States and studies pointed to a connection between increasing seismic events and the widespread disposal of wastewater into deep Class II[7] injection wells (GWPC 2021). Although most disposal wells in the United States do not pose a hazard for induced seismicity, seismic events can occur when specific geologic conditions are present (e.g., sufficient pore pressure build-up near a pre-existing fault of concern) (GWPC 2021; Oklahoma Corporation Commission 2021). A combination of many factors is necessary to induce felt earthquakes: the injection rate and total volume injected, the presence of faults that are large enough to produce felt earthquakes, stresses that are large enough to produce earthquakes, and the presence of pathways for the fluid pressure to travel from the injection point to faults (Machette et al. 2000; USGS 2021). High injection rates of greater than 300,000 barrels (bbl) per month are much more likely to be associated with earthquakes, and any earthquake within approximately 10 to 30 kilometers (km) (6.2–18.6 miles) of an active injection well could be associated with that well (Oklahoma Corporation Commission 2021; Weingarten et al. 2015). Although hydraulic fracturing can also contribute to induced seismicity, seismic events triggered by hydraulic fracturing are relatively uncommon and generally have smaller magnitudes than injection-induced seismicity and are therefore considered to pose less risk (GWPC 2021; Oklahoma Corporation Commission 2018). Even relatively extreme seismic events associated with hydraulic fracturing have been well below the damage threshold for modern building codes (Petersen et al. 2018; USGS 2021).

Seismically, the San Juan Basin is a relatively quiescent sedimentary basin in the Four Corners region of the United States. Since 1996, only 30 earthquakes of magnitude 2.5 or greater in the basin are reported in the USGS database, including two events estimated to have magnitudes of approximately 5.0. One occurred in 1966, and the other occurred in 1976 (McCormack et al. 2022). The San Juan Basin has not been associated with induced seismicity (Weingarten et al. 2015, Davis and Fisk 2017). In 2018, the San Juan Basin was situated in an area forecast to have less than a 1% annual chance of potentially minor-damage ground shaking (Petersen et al. 2018; USGS 2018). The Galina and Nacimiento faults, which are situated on the eastern boundary of the San Juan Basin, are predominantly normal faults and experience vertical displacement of less than 0.2 millimeters per year (USGS 2021).

The risks for induced seismicity increase with high-volume injections into deep wells carried out through wastewater injections or saltwater disposal (SWD) (Ellsworth 2013) and enhanced oil recovery techniques. A combination of many factors is necessary for injection to induce felt earthquakes; the injection rate and total volume injected, the presence of faults that are large enough to produce felt earthquakes, stresses that are large enough to produce earthquakes, and the presence of pathways for the fluid pressure to travel from the injection point to faults (Machette et al. 2000; USGS 2021). High injection rates of greater than 300,000 barrels per month are much more likely to be associated with

[7] Class II wells dispose of fluid produced in conjunction with oil and gas drilling, completion, and production operations (GWPC 2021).

earthquakes, and any earthquake within 15 km (9.3 miles) of an active injection well is considered to be associated with that well (Weingarten et al. 2015).

The BLM's regulations state that "for an injection well proposed on Federal or Indian leases, the operator shall obtain an underground injection control (UIC) permit pursuant to 40 C.F.R. Sections 144 and 146 from the EPA or the State/Tribe where the State/Tribe has achieved 'primacy.'" 43 C.F.R. § 3177.7. The EPA classifies these wells as Class II injection wells, which are wells used for disposal of fluids associated with the production of oil and natural gas (hydrocarbons), to inject fluids for enhanced oil recovery (EOR), or for the storage of liquid hydrocarbons. New Mexico's UIC Program monitors and regulates the injection of fluids into the subsurface. New Mexico regulations set limits on maximum allowable injection pressures and require mechanical integrity testing of the boreholes, pressure monitoring, and reporting. All injection wells permitted by NMOCD are subject to limitations on surface-injection pressure. Wells are required to be equipped with a pressure-limiting device that ensures that the maximum surface injection pressure is not exceeded (NMOCD 2004). Compliance officers from the NMOCD periodically inspect wells and surface facilities to ensure wells and related surface equipment are in good repair and meet regulations (NMOCD 2004).

Approximately 1,330,000 bbl of produced water are projected from future potential development of the estimated 16 wells within the nominated lease parcels. Assuming a 20-year production time frame, this equates to an average of approximately 5,542 bbl of produced water per month across the nominated lease parcels.

Disposal of produced water is the primary cause of anthropogenic felt earthquakes in New Mexico and across the central part of the United States. However, well drilling and completion activities associated with future potential development of the nominated lease parcels are not anticipated to noticeably contribute to induced seismicity in the FFO because these activities would be minor in the context of existing oil and gas development in the region and produced water disposal will occur in adherence to BLM and NMOCD regulations limiting injection pressure and reducing the risk of induced seismicity events.

Produced water may be addressed by

- injecting the produced water into EOR injection wells (typically shallower wells drilled into the hydrocarbon producing zone) to enhance oil recovery in producing oil and gas wells,
- disposing of produced water in SWD wells (typically deeper wells drilled to depths below the hydrocarbon producing zone),
- disposing of produced water in evaporation ponds, or
- reusing the produced water elsewhere in the hydraulic fracturing process.

Currently, evaporation ponds are used sparingly for disposal of produced water because of wildlife and habitat disturbance concerns. Reuse of produced water for hydraulic fracturing is not widespread because the chemical makeup of produced water often is not compatible with hydraulic fracturing procedures; therefore, most produced water ends up in EOR or SWD wells.

Currently for the San Juan Basin area, no active injection wells occur within 15 km (9.3 miles) of recent seismic activity nor does their monthly injection exceed 300,000 barrels (NMOCD 2023a; USGS 2023). There is one active injection well and 10 SDW within five miles of the nominated lease parcels:

All but one (API 30-045-32447) have never exceeded an average monthly injection volume of 300,000 bbl since the earliest NMOCD production records began in 1992 (NMOCD 2023b).

Future potential development of the lease parcels would result in approximately 1,330,000 bbl of produced water over the lives of the wells (5,542 bbl per month), compared with a total of 1,030,473,293 bbl of produced water in 2022 from New Mexico (NMOCD 2022). Based on the New Mexico regulatory program for injection wells, the amount of produced water anticipated from future potential development of the nominated lease parcels, the availability of produced water disposal methods, and the current risk of large-magnitude earthquakes in the San Juan Basin, the leasing and future potential development of the nominated lease parcels are not expected to result in induced seismicity of magnitude 2.5 or greater.

AIB-4 Sensitive Soils

How would future potential development of the nominated lease parcels affect fragile soils and/or soil stability?

Soil movement disrupts the existing structure of the soil horizons to the depth of disturbance. Soil-forming processes are halted, and compaction of underlying horizons and loss or degradation of soil microbes may occur. These issues are compounded when fragile and/or sensitive soils are present. Fragile soils are soil types that are easily damaged by use or disturbance and/or are those that are difficult to restore to pre-disturbance condition. Additionally, sensitive soils may include those that have components that can be characterized as susceptible to compaction or other mechanical damage and/or are highly erodible when disturbed. Surface disturbance of fragile and/or sensitive soils occurring on increased slope profiles has the potential to affect soil stability and may lead to accelerated soil erosion and potential sedimentation to proximal water bodies (see AIB-2 for more information).

Within the BLM FFO, examples of managed fragile soils include soils containing microbial crusts, soils susceptible to wind or water erosion, and soils on slopes greater than 15 percent. These types of sensitive soils are scattered throughout the 7.8 million-acre FFO. Of the approximately 2 million acres of federal surface within the FFO portion of the MGFAA, approximately 561,000 acres (13.4%) are considered fragile soils.[8]

The potential for adverse effects on sensitive soils would depend on site-specific locations. Soil effects are generally considered long term based on the amount of time it takes for soil to be rebuilt through deposition. Reasonably foreseeable cumulative actions within the MGFAA would result in 25,660 acres of new surface disturbance and 157,250 acres of total landscape disturbance, of which the future potential development of the nominated lease parcel would comprise approximately 102.1 acres (0.4% and 0.06%, respectively; see Table 3.2). These actions would result in long-term disturbance to soils, with related reductions of soil-forming processes and compaction of underlying horizons, and potential loss or degradation of soil microbe communities. Future potential development of the nominated lease parcels would affect the physical and biological integrity of soils within the area of surface disturbance. Surface disturbance associated with future potential development of the nominated lease parcels (approximately 102.1 acres) would comprise 0.0013% of the 7.8 million-acre FFO, 0.002% of the 4.8 million-acre MGFAA, and 1.65% of the total nominated lease parcels (6,179.02 acres). These actions would result in long-term disturbance to soils, with related reductions of soil-forming processes and compaction of underlying horizons, and potential loss or degradation of soil microbe communities.

[8] Sensitive soil data for the RPFO portion of the MGFAA is not available.

Sensitive soils have a high erosion risk due to a combination of soil erodibility characteristics, slope length, and slope gradient. Based on the Natural Resource Conservation Service (NRCS) soil surveys, FFO has identified three soil types in San Juan County [Badland (BA), Gypsiorthids-Badlands-Stumble Complex (GY), and Rock Outcrop-Travessilla-Weska Complex (RT)] and three soil types in Rio Arriba County [Pinavetes-Florita Complex (9), Sparank-San Mateo Silt Loam (10), and Rock Outcrop-Vessill-Menefee Complex (220)] that are potentially sensitive depending on the percent of slope. Slopes greater than 15% are found in 11 nominated lease parcels, and sensitive soils exist in 9 nominated parcels (Table 3.6).

Table 3.5. Sensitive Soils within the Nominated Lease Parcels

Parcel (total parcel acreage)	Sensitive Soils Present in Parcel (acres, % of total parcel acreage)*	Total Area of Sensitive Soils Intersected by Parcels (acres)*	Slopes greater than 15%? (if yes, acres and percent of total parcel acreage are given)*
024 (640)	Rock Outcrop-Vessila-Menefee-Orlie Association (~355 acres, 55%)	355	~20 acres (3%)
03-025 (640)	Rock Outcrop-Vessila-Menefee-Orlie Association (~475 acres, 74%)	475	~36 acres (6%)
026 (40)	Badland (~14 acres, 35%)	14	~12 acres (30%)
033 (160)	Badland (~50 acres, 31%)	50	~25 acres (16%)
037 (160)	None	0	~1 acre (0.6%)
038 (320)	Badland (~50 acres, 16%)	50	~29 acres (9%)
039 (1,122.85)	Badland Rock Outcrop – Persayo Complex (~27 acres, 2.4%); Badland (~20 acres, 1.8%)	47	~22 acres (2%)
040 (80)	None	0	None
041 (160)	None	0	None
042 (240)	Badland (~85 acres, 35%)	85	~11 acres (5%)
043 (709.29)	None	0	None
044 (712.28)	None	0	None
045 (714.6)	Badland (~70 acres, 10%)	70	~39 (5%)
046 (160)	None	0	None
06-025 (160)	None	–	~5 acres (3%)
047 (160)	Stout-Kunz sandy loam (68 acres, 43%)	68	~47 acres (29%)

To prevent potential impacts to fragile soils, Lease Stipulation F-46-CSU (Topography) is applied to the nominated lease parcels containing sensitive soils (parcels 037-039). This stipulation would not allow surface disturbance on slopes 15% or greater, and occupancy or use of fragile soils would be considered

on a case-by-case basis (see Appendix B). For other parcels containing steep slopes, the BLM's authority under Section 6 of the standard lease terms and conditions would result in the application of measures to avoid or mitigate impacts on the physical and biological integrity of soils during the development of a lease. At the APD stage, the BLM would apply COAs requiring operators to avoid disturbing sensitive soils on nominated lease parcels. Site-specific analysis would occur at the lease development level, and the lessee would be required to follow applicable COAs, and reclamation measures as determined by the BLM to reduce impacts to or avoid sensitive soils. These may include measures such as topsoil stockpiling and pad placement in respect to topography and other factors to further mitigate effects on the physical and biological integrity of soils during the development of a lease.

AIB-5 Vegetation

How would future potential development of the nominated lease parcels affect vegetation?

Surface disturbance associated with reasonably foreseeable cumulative actions within the FFO would remove surface vegetation, altering the plant community composition, increasing the potential for erosion and soil compaction, and increasing the likelihood for the introduction of noxious weeds (see AIB-6). In these arid plant communities, low rainfall combined with limited soil organic matter contributes to communities with low disturbance level thresholds and lack of resilience. Removal of vegetation may leave fragmented plant communities that would not recover to pre-disturbance levels without reclamation measures, which may take years to achieve (BLM 2003); consequently, this would be a long-term effect. Vegetation resources may also be subject to increased fragmentation of vegetative types, introduction of invasive species, and potential for monocultures to develop. Many of the significant adverse effects on landscape vegetation density and type resulting from surface disturbances would also be long term. At the landscape level, vegetation rehabilitation efforts such as Restore New Mexico (USGS 2019) would continue to offset the impacts of surface disturbance to vegetation by plugging and reclaiming existing and active wells to their former vegetative conditions, and a countervailing impact to vegetation would also occur.

Reasonably foreseeable cumulative actions within the MGFAA would result in a total of 25,660 acres of new surface disturbance for a total of 157,250 acres of total landscape-level surface disturbance, of which the future potential development of the nominated lease parcels would compose approximately 102.1 acres (0.4% and 0.06%, respectively) (Table 3.2). This surface disturbance may contribute to landscape-level variations in plant communities dependent on success of reclamation activities and concurrent effects of climate change, such as warmer temperatures, changes in rainfall and runoff, and the resulting shifts in vegetation communities (BLM and BIA 2020).

The nominated lease parcels are within the Southern Rockies Level 3 Ecoregion, the Foothill Shrublands Level 4 Ecoregion, Arizona/New Mexico Plateau Level 3 Ecoregion, San Juan. Chaco Tablelands and Mesas Level 4 Ecoregion (Griffith et. al 2006). Based on review of Landscape Fire and Resource Management Planning Tools (LANDFIRE) geographic information system (GIS) data (LANDFIRE 2023), the nominated lease parcels are covered by the vegetation types listed in Table 3.7.

Table 3.6. Vegetation Types within the Nominated Lease Parcels

Land Cover Vegetation Types*	Total Area of Vegetation Type Intersected by Parcels (acres)†	Parcel within Vegetation Types* (percent of parcel containing vegetation type)
Colorado Plateau mixed bedrock canyon and tableland	185.09	024 (2.43%), 03-025 (1.82%), 026 (15%), 033 (2.04%), 037 (9.66%), 038 (16.2%), 039 (3.68%), 040 (0.09%), 041 (0.69%), 042 (11.21%), 043 (0.06%), 044 (0.06%), 045 (1.55%)

Land Cover Vegetation Types*	Total Area of Vegetation Type Intersected by Parcels (acres)†	Parcel within Vegetation Types* (percent of parcel containing vegetation type)
Colorado Plateau mixed low sagebrush shrubland	277.70	026 (19.59%), 033 (12.25%), 037 (11.09%), 038 (22.02%), 039 (2.09%), 040 (0.1%), 041 (2.95%), 042 (27.33%), 043 (0.06%), 044 (0.56%), 045 (8.78%), 046 (0.67%)
Colorado Plateau pinyon-juniper shrubland	1.05	041 (0.52%), 045 (0.03%)
Colorado Plateau pinyon-juniper woodland	296.80	024 (3.91%), 03-025 (7.58%), 033 (0.28%), 047 (86.1%), 06-025 (53.43%)
Developed-Low Intensity	4.54	024 (0.21%), 03-025 (0.07%), 043 (0.11%), 044 (0.12%), 045 (0.1%),
Developed-Medium Intensity	0.89	024 (0.07%), 03-025 (0.03%), 045 (0.03%)
Developed-Roads	146.91	043 (7.36%), 044 (4.08%), 045 (9.19%)
Great Basin and intermountain introduced annual and biennial forbland‡	1.78	024 (0.1%), 038 (0.28%), 042 (0.09%)
Great Basin and intermountain ruderal shrubland‡	10.86	041 (1.31%), 042 (3.56%), 06-025 (0.14%)
Inter-mountain basins big sagebrush shrubland	3223.84	024 (43.02%), 03-025 (23.94%), 026 (16.85%), 033 (67.19%), 037 (38.65%), 038 (25.23%), 039 (85.92%), 040 (75.37%), 041 (79.36%), 042 (11.6%),043 (46.8%), 044 (71.95%), 045 (51.12%), 046 (88.46%), 047 (0.08%), 06-025 (4.52%)
Inter-mountain basins greasewood flat	34.03	026 (1.02%), 033 (1.77%), 037 (0.42%), 038 (3.66%), 039 (0.51%), 043 (0.93%), 040 (0.28%), 042 (0.79%), 046 (0.14%), 06-025 (2.34%)
Inter-mountain basins mixed salt desert scrub	634.21	024 (28.34%), 03-025 (24.62%), 026 (8.81%), 037 (30.36%), 038 (11.77%), 039 (3.3%), 033 (5.61%) 040 (10.79%), 041 (7.56%), 042 (9.39%), 043 (9.28%), 044 (3.6%), 045 (1.88%), 046 (2.83%), 047 (4.11%), 06-025 (0.14%),
Inter-mountain basins montane sagebrush steppe	144.75	024 (1.58%), 03-025 (19.33%), 047 (3.75%), 06-025 (3.08%)
Inter-mountain basins semi-desert grassland	89.94	024 (2.77%), 03-025 (0.69%), 026 (6.21%), 037 (4.36%), 038 (7.08%), 039 (1.16%), 040 (0.18%), 042 (0.38%), 043 (2.43%), 044 (0.3%), 046 (0.86%), 06-025 (0.49%)
Inter-mountain basins semi-desert shrub-steppe	710.94	024 (13.65%), 03-025 (13.93%), 026 (28.53%), 033 (7.37%), 037 (1.05%), 038 (4.59%), 039 (1.08%), 040 (10.1%), 041 (6.82%), 042 (25.65%), 043 (21.84%), 044 (14.62%), 045 (18.51%), 046 (6.12%), 06-025 (0.69%)
Inter-mountain basins shale badland	79.62	037 (2.97%), 038 (1.74%), 039 (0.32%), 042 (8.99%), 044 (0.2%), 045 (5.98%)
Interior western North American temperate ruderal shrubland	40.29	024 (0.35%), 03-025 (5.7%), 047 (0.97%)
Rocky Mountain alpine-montane wet meadow	0.22	06-025 (0.14%)
Rocky Mountain gambel oak-mixed montane shrubland‡	8.21	024 (0.63%), 03-025 (0.43%), 047 (0.14%), 06-025 (0.78%)
Rocky Mountain lower montane-foothill riparian shrubland‡	0.25	024 (0.02%), 06-025 (0.08%)
Rocky Mountain lower montane-foothill riparian woodland‡	3.11	06-025 (1.95%)

Land Cover Vegetation Types*	Total Area of Vegetation Type Intersected by Parcels (acres)†	Parcel within Vegetation Types* (percent of parcel containing vegetation type)
Rocky Mountain lower montane-foothill shrubland‡	12.57	024 (0.03%), 06-025 (7.72%)
Southern Colorado Plateau sand shrubland	195.88	024 (1.33%), 03-025 (1.01%), 026 (4.47%), 033 (2.31%), 037 (2.21%), 038 (6.92%), 039 (1.39%), 040 (3.01%), 041 (0.68%), 042 (1.06%), 043 (10.64%), 044 (4.36%), 045 (2.8%), 046 (0.98%)
Southern Rocky Mountain Montane-Subalpine Grassland	0.67	06-025 (0.42%)
Southern Rocky Mountain pinyon-juniper woodland	34.05	06-025 (21.28%)
Southern Rocky Mountain ponderosa pine woodland	7.56	047 (2.14%), 06-025 (2.58%)
Western cool temperate developed shrubland	9.72	024 (0.94%), 03-025 (0.35%), 033 (0.93%)
Western cool temperate fallow/idle cropland	0.22	041 (0.14%)
Western cool temperate urban evergreen forest	0.22	06-025 (0.14%)
Western cool temperate urban shrubland	16.67	024 (0.92%), 03-025 (0.68%), 033 (1.21%), 043 (0.45%), 044 (0.15%), 045 (0.03%)

Note: The analysis contained in this EA generally provides percentage contribution rounded to two decimal points. As such, percentages may not total 100 because of rounding.

* Source: LANDFIRE GIS data (LANDFIRE 2023)

† All acreages contained in the EA analysis were calculated using GIS data sets for resources and parcels, which may differ slightly from the acreages contained in legal description here and in Table 2.1. Difference in total acres between the parcels and acres analyzed in the EA can vary slightly because of geoprocessing operations where slivers of area are created when two or more data sets intersect. Any inaccuracies are negligible and do not change the overall effect analysis conclusions presented in this EA.

‡ Indicates rare and unique vegetation types. Rare and unique vegetation types are based on existing vegetation types that encompass 1% or less of the analysis area (Sandbom 2020). This does not include vegetation types which are human made, such as row crops or urban landscapes.

Seven nominated lease parcels contain rare and unique vegetation types (see Table 3.6). These vegetation types are categorized as rare and unique because they comprise less than 1% of present vegetation in the FFO planning area. There are no stipulations that would prohibit future potential development within the rare or unique land cover types, but this acreage could reasonably be avoided through the application of standard terms and conditions. Additionally, stipulations applied to these parcels for other ecological concerns (e.g., sensitive soils [AIB-4], and sensitive species [AIB-8], and cultural resources [AIB-17]) may provide protections to rare and unique vegetation types found on the nominated lease parcels if they intersect these same ecological features. See Appendix B for additional lease notice details.

In the event that all surface disturbance associated with development of the seven nominated lease parcels were to occur in a single common vegetation type, the level of estimated disturbance (102.1 acres collectively) would only affect a small fraction of said habitat type throughout the FFO (rare and unique habitat types cover approximately 9,400 acres of the FFO, on average) and would not result in a substantial change to the overall characteristics or availability of the vegetation type across the analysis area. This surface disturbance may contribute to landscape-level variations in plant communities dependent on success of reclamation activities and concurrent effects of climate change, such as warmer temperatures, changes in rainfall and runoff, and the resulting shifts in vegetation communities. Note that the time frame for successful reclamation would vary by vegetation type and other factors such as the amount and timing of annual precipitation. Thus, the estimated level of disturbance would not pose a threat to the viability of species composing these communities or ecoregions, nor to any species using common vegetation for habitat.

Standard terms and conditions would apply to the parcels, lease notice F-41-LN (applied to parcels 037-039, 06-025 and 047) and NM-1-LN (applied to all parcels except 06-025 and 047) to notify leaseholders of the requirement for biological surveys prior to surface-disturbing activities. The surveys would identify occurrence of rare or unique vegetation types, special status plant species, and/or vegetation providing habitat for special status wildlife species for avoidance during project siting and construction (see AIB-7 and AIB-8 for more information). The BLM would conduct site-specific evaluations at the lease development stage for any future actions within the lease parcel to determine whether impacts to sensitive species would occur. Avoidance, minimization, and/or mitigation measures would also be determined at that time. Standard terms and conditions would also include interim and final reclamation requirements and provide the BLM with the authority to determine site-specific vegetation management strategies at the lease development stage, including the management of woodland species.

AIB-6 Invasive Species (Noxious Weeds)

How would future potential development of the nominated lease parcels affect the introduction and/or spread of noxious weeds and invasive plants?

Within the FFO planning area, invasive and noxious weed populations are primarily a concern within the MGFAA, where most surface disturbance and development has occurred (BLM 2003). The MGFAA has observed an increase in noxious weed/invasive plant populations in recent years, and there appears to be a direct correlation between development and associated disturbed areas and the establishment and spread of noxious and/or invasive plants. Twelve species of noxious weeds have been inventoried in the FFO portion of the MGFAA[9] (BLM 2015). Halogeton (*Halogeton glomeratus*), Russian knapweed (*Acroptilon repens*), and musk thistle (*Carduus nutans*) are some of the most widespread and problematic invasive species in the MGFAA (BLM 2015).

Invasive and noxious weeds invade disturbed sites, spread into adjacent areas, compete with and potentially displace native vegetation, and can contribute to the degradation of soil health by overusing soil nutrients. Surface disturbance, construction equipment, and source materials brought on-site (e.g., caliche, gravel) associated with reasonably foreseeable cumulative actions within the MGFAA (approximately 25,660 acres of new surface disturbance and 157,250 acres of total landscape disturbance) would likely increase the spread and density of invasive plants and noxious weeds over the long term. Additionally, livestock grazing (which covers approximately 1.2 million acres of BLM managed lands in FFO) may potentially spread noxious, invasive, or nonnative species through equipment, feed products, and on livestock themselves. At the landscape level, vegetation rehabilitation efforts such as Restore New Mexico (USGS 2019) would continue, existing and active wells would be plugged and reclaimed to former vegetative conditions, and a countervailing impact to vegetation would also occur.

Reasonably foreseeable cumulative actions within the MGFAA would result in 25,660 acres of new surface disturbance for a total of 157,250 acres of total landscape-level surface disturbance, of which the future potential development of the nominated lease parcels would comprise approximately 102.1 acres (0.06% of total landscape-level surface disturbance; see Table 3.2). This would also result in a concomitant increase in risk of establishment of noxious weeds. All disturbed acreage would be vulnerable to the long-term establishment and spread of noxious weeds/invasive plants until successful reclamation.

Within the MGFAA, the BLM, the state of New Mexico, and other entities are engaged in ongoing efforts to reduce the presence and spread of these unwanted species by way of prevention and treatment. The most common treatment method is the application of herbicides. In general, the effectiveness of

[9] It is unknown how many species of noxious weed occur within the RPFO portion of the MGFAA.

treatments is variable depending on location, species, treatment type, timing of treatment, and size of population. If noxious weeds are discovered at any time during future potential development, standard lease terms and conditions hold the operator responsible for weed treatment and prevention activities, such as herbicide application and washing vehicles coming from areas with known weed populations.

Reclamation is intended to restore previously disturbed sites to a properly functioning, natural ecological state. The effectiveness of reclamation efforts varies based upon factors such as soil type, precipitation, herbicide treatments, and additional disturbance. Once physical reclamation of the site has taken place, seeding of native species is intended to reestablish the native plant community and protect the disturbed area from potential establishment of noxious weeds. While reclamation has been shown to increase and restore the health of disturbed sites, the complete eradication of noxious weed species is challenging, and initiation of large-scale control efforts is not feasible at this time (BLM and BIA 2020).

Together with the standard lease terms and conditions, site-specific approval requirements require permit holders to treat weeds to help offset the effects of development by limiting the spread of noxious weeds across the MGFAA and to contribute to controlling the spread on a landscape level. The remaining adverse effects from development include the potential introduction of new invasive species. These remaining effects would be long term if full eradication of certain introduced species is not achieved.

AIB-7 Threatened and Endangered Species

How would future potential development of the nominated lease parcels affect threatened and endangered (T&E) species?

The potential for threatened and endangered species and their associated habitats to occur within the nominated lease sale parcels was determined through review of the best available data and a comparison of mapped habitat types in the nominated lease parcels with known habitat requirements of the species listed in Table 3.2. Data sources reviewed include the USFWS Information for Planning and Consultation (IPaC) system (USFWS 2023), LANDFIRE vegetation data, NHD data (see AIB-2 for further information), USFWS NWI data, USFWS descriptions of species habitat requirements and current mapped critical habitat (USFWS 2023), and BLM-mapped potential habitat for special status plant species.

Based on review of USFWS IPaC data (USFWS 2023), twelve species were evaluated for the potential to occur within the nominated lease parcels:

- Three bird species: Mexican spotted owl (*Strix occidentalis lucida*), southwestern willow flycatcher (*Empidonax traillii extimus*), and yellow-billed cuckoo (*Coccyzus americanus*)
- Four fish species: Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), Rio Grande cutthroat trout (*Oncorhynchus clarkii virginalis*) and Rio Grande silvery minnow (Hybognathus amarus)
- Two mammal species: Mexican gray wolf (*Canis lupus baileyi*) and New Mexico Meadow Jumping mouse (*Zapus hudsonius luteus)*
- One insect species: monarch butterfly (*Danaus plexippus*)
- Two plant species: Knowlton's cactus (*Pediocactus knowltonii*) and Mesa Verde Cactus (Sclerocactus mesae-verdae)

Of the twelve species listed above, only monarch butterfly was determined to have the potential to occur within the nominated lease parcels based on the presence of potentially suitable habitat (Table 3.8). The nominated lease parcels are outside the critical habitat for this species.

Table 3.7. USFWS IPaC System ESA-listed Threatened and Endangered Species with Suitable Habitat on or in the Vicinity of the Nominated Lease Parcels

Species (scientific name) (status)*	Suitable Habitat within Nominated Lease Parcels	Discussion†, ‡
Insects		
Monarch butterfly (*Danaus plexippus)* (C)	All parcels	Monarch butterflies can feed on the nectar of many flowering plants in various habitat types (e.g., fields, roadside areas, wetlands, or urban gardens), but they only breed on milkweed (*Asclepias* spp.) species (USFWS 2022). Given the lack of site-specific flowering plant species data, and the generalist habitat requirements for monarch butterflies, the nominated lease parcels may contain suitable habitat. Site-specific analysis at the lease development stage will provide an additional opportunity to evaluate suitable habitat for this species.

*C = candidate species undergoing USFWS review

† The nominated lease parcels are not within species-specific critical habitat.

‡ See Appendix B for summaries of stipulations and lease notices.

See Appendix B for summaries of stipulations and lease notices. Surface disturbance associated with reasonably foreseeable cumulative actions within the MGFAA (25,660 acres of new surface disturbance and 157,250 acres of total landscape-level disturbance) may reduce suitable habitat and increase fragmentation, which could affect ESA-listed species occurring within the planning area, including but not limited to those listed in Table 3.8.

At the landscape level, implementation of land restoration and conservation activities listed in Section 3.3.2 would continue to help offset the impacts of surface disturbance on habitats and may result in beneficial impacts to habitat dependent on the site-specific success of restoration activities and concurrent effects of climate change.

According to stipulation WO-ESA, which is applied to the nominated lease parcels, the BLM would not approve any ground-disturbing activity that may affect species or critical habitat until it completes its obligations under applicable requirements of the ESA. In addition, the BLM may require modifications to or disapprove a 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 (see Table 2.1 and Appendix B). Section 4.1 further discusses BLM's continued review of the available climate science in connection with its statutory responsibilities and how the Proposed Action would comply with threatened and endangered species management guidelines outlined in the Farmington RMP (BLM 2003), as amended (BLM 2014, 2015), and the 2002 Biological Assessment for the 2003 Farmington RMP (BLM 2002) as well as ESA Section 7 consultation requirements.

AIB-8 Sensitive Species

How would future potential development of the nominated lease parcels affect sensitive species?

The potential for sensitive species and their associated habitats to occur within the nominated lease sale parcels was determined through review of the best available data and a comparison of mapped habitat types in the nominated lease parcels with known habitat requirements of the sensitive species. The BLM reviewed aerial mapped vegetation communities (see AIB-5), NHD (see AIB-2), and published descriptions of species habitat requirements (BLM 2008a).

Surface disturbance associated with reasonably foreseeable cumulative actions within the MGFAA (25,660 acres of new surface disturbance and 157,250 acres of total landscape-level disturbance) is not anticipated to create significant adverse effects. Depending on the proximity of ground disturbance and development activity to sensitive species habitat and/or populations, there may be short-term effects (i.e., temporary displacement from habitat because of noise and construction) or long-term effects on sensitive species and the ecological processes that sustain them related to changes in the following habitat conditions: ground cover, soil nutrient flows and processes, hydrological flows and processes, solar exposure, thermal cover, fugitive dust loads, non-native species dispersal, habitat connectivity, noise levels and human activity, light pollution, forage availability, and pollinator and dispersal agents' visitation behaviors; these include both direct and indirect impacts. If detected and avoided, actual impacts to special status plant species would be less than the potential effects estimated in this analysis. It is not certain that detected occupied habitat could be avoided, given valid existing lease rights and other resource conflicts in the vicinity of proposed development locations. However, methods to minimize impacts to sensitive species and habitats would be applied for foreseeable cumulative actions whenever applicable and consistent with valid existing lease rights. Effects may also be lower than the estimated potential when single pads host multiple wells. The remaining surface disturbance across the landscape would contribute to additional potential for habitat loss and fragmentation that could affect sensitive species. At the landscape level, implementation of land restoration and conservation activities listed in Section 3.3.2 would continue to offset the effects of surface disturbance on habitats and may result in beneficial impacts to habitat dependent on the success of restoration activities and concurrent effects of climate change.

As described in AIB-7, the BLM continues to review the available climate science in connection with its statutory responsibilities, including under NEPA, and has found that despite advances in climate science, global climate models are unable to forecast local or regional effects on resources as a result of specific emissions (such as emissions resulting from the future potential development of the nominated lease sale parcels) given the accumulated and persisting GHGs already in the atmosphere, the annual volume of GHG emissions that will occur globally regardless of additional lease issuance, and projected continued climate change.

The BLM has identified potential habitat within all nominated lease parcels for nine sensitive species (Table 3.9); therefore, sensitive species have the potential to occur within all of nominated lease parcels. Site selection of the 102.1 acres of potential surface disturbance associated with the development of the nominated lease parcels would occur after pre-disturbance biological surveys and additional review and disclosure of potential effects on sensitive species at the time of lease development. For more information regarding general wildlife, including game species and the New Mexico State Wildlife Action Plan, see AIB-13.

Lease notice NM-1-LN has been applied to all nominated lease parcels which would provide protections to sensitive plant species that may occur within these parcels. Lease notice F-41-LN also applies to parcels 037-039, 06-025 and 047. Additionally, stipulations applied to these parcels for other ecological concerns (e.g., surface water [AIB-2] and sensitive soils [AIB-4]) may provide protections to sensitive species that use those habitats. See Appendix B for additional lease notice details.

Table 3.8. Potential Sensitive Species Habitat within Nominated Lease Parcels

Species (scientific name)	Potential Habitat (Y/N)	Parcel Number(s)	Discussion
Birds			
Bendire's thrasher (*Toxostoma bendirei*)	Y	All parcels	This species inhabits sparse, desert shrublands and open woodlands with scattered shrubs. Avoids riparian areas and arroyos with dense shrub cover. In New Mexico, the species breeds in scattered locations in the central and western portions of the state and inhabits a variety of habitats including sagebrush shrubland with scattered juniper, desert habitat with medium- to large-sized shrubs, degraded desert grasslands, desert shrublands with little grass cover, and cholla stands (New Mexico Avian Conservation Partners 2017). This species has the potential to occur in the BLM FFO planning area during the breeding-nesting season. The nominated lease parcels contain desert shrubland and open woodland habitat, which may indicate potential habitat for this species (see AIB-5).
Pinyon jay (*Gymnorhinus cyanocephalus*)	Y	All parcels	This species is predominantly associated with the pinyon-juniper (*Pinus* and *Juniperus*) woodland vegetation community, especially two-needle pinyon (*Pinus edulis*). May occur in areas with ponderosa pine (*Pinus ponderosa*), sagebrush (*Artemisia sp.*), and chaparral vegetation. Breeding sites consist of dense, mature stands of pinyon-juniper woodlands (New Mexico Avian Conservation Partners 2020). This species is known to occur in the BLM FFO planning area as a permanent resident. This species has potential to occur on all nominated lease parcels due to the presence of suitable sagebrush shrubland foraging habitat and the presence of pinyon-juniper woodlands (see AIB-5).
Mammals			
Gunnison's prairie dog (*Cynomys gunnisoni*)	Y	All parcels	This species occurs in grassland and shrub-steppe habitat at elevations ranging from semi-desert to montane between 4,500 and 10,000 feet above mean sea level. This species can be found in a variety of habitats including montane grasslands, juniper (*Juniperus* spp.) savannas, plains-mesa grasslands, Great Basin Desert scrub, plains-mesa sand scrub, desert grasslands, and in urban and cultivated areas. They prefer predominantly graminoid and herbaceous plant cover with few or no trees and variable shrub density (NMDGF 2008). This species has the potential to occur in all nominated lease parcels due to the presence of suitable habitat (see AIB-5). Parcels 024, 033, 039, 040, 041, 043, 044, and 046 may have a higher probability for presence due to higher concentrations of the Great Basin and Intermountain Tall sagebrush shrubland and steppe vegetation (see AIB-5).

Species (scientific name)	Potential Habitat (Y/N)	Parcel Number(s)	Discussion
Burrowing owl (Athene cunicularia)	Y	All parcels	This species occurs in grassland and shrub-steppe habitat at elevations ranging from semi-desert to montane between 4,500 and 10,000 feet above mean sea level. This species can be found in a variety of habitats including montane grasslands, juniper (*Juniperus* spp.) savannas, plains-mesa grasslands, Great Basin Desert scrub, plains-mesa sand scrub, desert grasslands, and in urban and cultivated areas. They prefer predominantly graminoid and herbaceous plant cover with few or no trees and variable shrub density (NMDGF 2008). This species has the potential to occur in all nominated lease parcels due to the presence of suitable habitat (see AIB-5). Parcels 024, 033, 039, 040, 041, 043, 044, and 046 may have a higher probability for presence due to higher concentrations of the Great Basin and Intermountain Tall sagebrush shrubland and steppe vegetation (see AIB-5). The species is known for living in abandoned mammal burrows that they may enlarge. Burrows may originally be dug by prairie dogs (Cynomys spp.), ground squirrels, or other species.
Plants			
Clover's cactus (*Sclerocactus cloverae*)	Y	All parcels	This species occurs in salt desert shrublands on soils derived from the Nacimiento and San Jose Formations and is known to occur in the BLM FFO planning area. The USGS Clover's cactus suitability model indicates varying amounts of potential suitable habitat on all parcels.
Aztec gilia (*Aliciella formosa*)	Y	37, 38, 39, 41-45, 03-25, 26, 33	This species occurs within badland hills of the Nacimiento Formation and is known to occur withing the BLM FFO planning area. The USGS Aztec gilia suitability model was used to determine parcels with potential suitable habitat.
San Juan Milkweed *(Asclepias sanjuanensis*)	Y	40-46	This species occurs within in juniper savannah and Great Basin desert scrub in San Juan County, NM. This species is known to occur within the BLM FFO planning area. Recent surveys have found populations within grassland habitat near Highway 371, south of Farmington.
Sivinski's Blazingstar (*Mentzelia sivinskii*)	Y	37, 38, 39, 41-45, 26, 33, 03-25	This species occurs frequently on soils derived from the Nacimiento Formation, in pinyon-juniper woodlands and salt scrub. It is often observed with populations of Aztec gilia and is known to occur in the BLM FFO planning area.
Mancos Saltbush (*Proatriplex pleiantha*)	Y	45	This species occurs on badland areas of the Mancos and Fruitland Formations and is known to occur in the BLM FFO planning area.

* Source: BLM (2018b)

Standard terms and conditions would apply to all nominated lease parcels, including a requirement of pre-disturbance surveys at the time of proposed lease development. The surveys would identify occurrences of special status plant species and special status wildlife habitat for avoidance during project siting and construction. The BLM would conduct site-specific evaluations at the lease development stage for any reasonably foreseeable cumulative actions within the lease parcels to determine whether effects on sensitive species would occur. Avoidance, minimization, and/or mitigation measures would also be determined at that time. The BLM is working with other land management agencies to restrict and manage development through establishment of management protocols to identify and map potential and occupied habitat requiring species-specific inventories and studies, as well as other requirements, before locating well pads and infrastructure.

AIB-9 Migratory Birds

How would future potential development of the nominated lease parcels affect migratory birds?

Habitat fragmentation, alteration, and/or loss within the MGFAA has changed how birds move through landscapes and use the remaining habitat. Loss, alteration, or fragmentation of habitat are among the main reasons why biodiversity is decreasing in many places worldwide (Taylor and Stutchbury 2016). The primary drivers of habitat loss and fragmentation within the MGFAA are oil and gas development, livestock grazing, and mining (see Table 3.2).

Within the 4.8 million-acre MGFAA, existing surface disturbance associated with past and present activities is estimated to be 131,590 acres (see Table 3.2), which comprises approximately 2.7% of the MGFAA and 1.7% of the FFO. Reasonably foreseeable environmental trends and planned actions within the MGFAA are estimated to result in approximately 25,660 acres of new surface disturbance, which represents 0.33% of the approximately 7.8 million-acre FFO and 0.53% of the 4.8 million-acre MGFAA (see Table 3.3). This landscape-level disturbance would further contribute to migratory bird habitat loss and fragmentation. Additionally, land restoration and conservation projects (outlined in Section 3.3) have improved habitat, in which migratory birds have benefitted from the improved herbaceous cover associated with these activities. Future restoration projects would likely produce similar effects where they are implemented.

Habitat loss, alteration, or fragmentation that occurs outside of the MGFAA can also contribute to population declines in respective migratory bird populations within MGFAA. Taylor and Stutchbury (2016:424) state “that habitat loss in one region can effect sub-populations in regions that are not directly connected.” Habitat loss on wintering grounds south of the United States–Mexico border, as well as local drought conditions, can contribute to population declines in migratory birds that occur within the MGFAA. This regional habitat continues to provide for the life cycles of these birds, notwithstanding the known drivers of habitat loss described above.

Most of the effects associated with reasonably foreseeable cumulative actions within the MGFAA would occur at the initial stages of lease development. These disturbances include construction and drilling, human presence, traffic, heavy equipment, and noise associated with lease development activities. Bird species not tolerant of noise and human disturbance may exhibit vigilance or flight behaviors or abandon the area altogether for the duration of construction; this is especially true in areas with high densities of development (NMDGF 2016). Habitat loss effects would be long term, and in some cases, reclamation would not fully rehabilitate migratory bird habitat to pre-development conditions, see AIB-5. For more information regarding general wildlife, including game species, and the New Mexico State Wildlife Action Plan (NMDGF 2019), see AIB-13.

All nominated lease parcels fall within North American Bird Conservation Initiative Bird Conservation Region (BCR) 16 (Southern Rockies/Colorado Plateau), which encompasses portions of Utah, Colorado, Arizona, and New Mexico (Partners in Flight 2021; USFWS 2023). BCR 16 is a topographically complex region in which birds often segregate by elevation bands, each with a different type of habitat. Characteristic breeding habitats include coniferous forests, alpine tundra, pinyon-juniper woodlands, prairies, and wetlands. There are 27 migratory bird species of conservation concern listed for BCR 16 (USFWS 2008). However, the USFWS IPaC system did not identify any bird species of conservation concern that would be expected to occur within 2 miles of the nominated lease parcel (USFWS 2023).

Future potential development of the nominated lease parcels would result in approximately 102.1 acres of total surface disturbance (0.06% of total landscape-level surface disturbance [157,250 acres]). This disturbance comprises 0.4% of the surface disturbance (25,660 acres) associated with the reasonably foreseeable environmental trends and planned actions within the MGFAA. Future potential development of nominated lease parcels would result in 102.1 acres (0.0003%) of surface disturbance for BCR 16 (32,798,043.80 acres). This surface disturbance could result in long-term habitat loss and fragmentation, depending on the proximity of disturbance to migratory bird habitat.

Stipulation F-4-TL, which states that no surface occupancy is allowed for portions of the year when migrations of big game occur is applied to nominated lease parcels 06-025 and 047 and may also provide protections to migratory birds on the associated nominated lease parcels.

Compliance with the Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act would be required for any future potential developments and would follow the BLM FFO Migratory Bird Policy (BLM 2010b), which could include timing limitation constraints on developments within the nominated lease parcels during migration and nesting seasons, or requirements for netting over open water containing fluids that are harmful to migratory birds. Pre-disturbance surveys would be required at the time of proposed lease development in accordance with standard terms and conditions of the lease, as well as lease notice F-41-LN (applied to parcels 037-039, 06-025 and 047). The BLM applies measures to mitigate effects on migratory birds at the leasing stage. Developmental constraints during spring and fall migrations and nesting seasons, as well as nest surveys, may be required prior to implementation of lease development activities. Some of these include the application of netting over open tanks, raptor-safe power line construction standards, and sound mufflers. In addition, the BLM may require avoidance of active avian nests and burrows or delays of development activities to accommodate migratory birds.

AIB-10 Paleontological Resources

How would future potential development of the nominated lease parcels affect paleontological resources?

The Potential Fossil Yield Classification (PFYC) is a tool that allows the BLM FFO to predict the likelihood that a geologic unit contains paleontological resources. PFYC is based on a numeric system of 1 to 5. An area identified as PFYC 1 has a very low likelihood of containing paleontological resources, whereas an area identified as PFYC 5 is a geologic unit with a very high likelihood of containing scientifically significant paleontological resources. Within areas identified as PFYC 2 or 3, paleontological resource management concern is generally low to moderate because the likelihood of encountering scientifically significant fossils is relatively low to moderate. Within areas identified as PFYC 4, paleontological resource management concerns are moderate to high, as the probability of affecting scientifically significant paleontological resources is generally moderate to high.

Surface disturbance and the risk of effects on paleontological resources associated with reasonably foreseeable cumulative actions within the FFO's 25,660 acres of new surface disturbance and

157,250 acres of total landscape-level disturbance (see Table 3.3) would depend on the locations of proposed disturbance relative to PFYC class. As currently mapped, nearly the entire FFO analysis area is PFYC 3 (50.0% of planning area) or PFYC 5 (41.3% of planning area). As such, the risk would range from low to moderate (for PFYC 3) to very high (for PFYC 5). Effects would result in the immediate physical loss of fossils and their contextual data. Ground disturbance could also subject fossils to long-term damage or destruction from erosion and create improved access to the public and increased visibility, potentially resulting in unauthorized collection or vandalism. Ground disturbance can also reveal scientifically significant fossils that would otherwise remain buried and unavailable for scientific study. Such fossils can be collected properly and curated into the museum collection of a qualified repository, making them available for scientific study and education. Additionally, towards the southern end of the MGFAA, the Paleocene Nacimiento Formation is exposed at the surface in the many areas where oil and gas exploration activities are occurring. As such, increased requirements and protections for paleontological surveys and monitoring have led to an increased knowledge of fossil distribution, thereby increasing the ability to avoid them (BLM 2015). Future potential development of the nominated lease parcels would be analyzed further through separate NEPA processes, as directed by regulations and current policy.

Using currently available geological mapping at 1:500,000 scale, the BLM has determined that the nominated lease parcels are all mapped as PFYC 5. These PFYC 5 lands consist of geologic units that are highly fossiliferous and consistently and predictably produce significant paleontological resources. All nominated parcels are located within the San Jose Formation of the Eocene period geologic unit (Tsj), Nacimiento Formation of the Paleocene epoch, Fruitland or Kirkland Formation of the Cretaceous period. The geologic units that have the PFYC 5 value within the San Juan Basin include the Fruitland, Kirtland, Nacimiento, and San Jose Formations.

No known paleontological localities are within the nominated lease parcels. However, localities are located near many of the nominated lease parcels occurring within 120 ft to 2.5 miles of the nominated lease parcels. Future potential development of all nominated lease parcels would result in up to 102.1 acres of surface disturbance, 41.1 acres of which would occur within or near nominated lease parcels (03-25, 26, 33, and 40-42) with higher potential for paleontological resources, at approximately 6.85 acres per parcel.

Effects on paleontological resources can be mitigated by standard terms and conditions, which require a lessee to conduct inventories or special studies at the discretion of the BLM. Site-specific projects that would cause surface disturbance in areas with unknown or moderate to high potential may require a paleontological survey and/or monitoring conducted at the time of the proposed lease development in accordance with NEPA, Paleontological Resources Preservation Act (PRPA), and FLPMA. Mitigation measures may be applied as COAs based on the results of surveys conducted. If during operations within the nominated lease parcels paleontological resources are discovered and a permitted paleontological monitor is not on-site, the lessee must cease any operations that would result in the destruction of such specimens and contact the BLM AO. Scientifically significant paleontological resources discovered through surveys or monitoring would be collected by a permitted paleontologist and curated at an appropriate repository. These same measures for minimizing effects at the site-specific level would be followed for resources associated with reasonably foreseeable cumulative actions. Additionally, the BLM applied stipulation F-39-NSO to nominated lease parcels 03-25, and 026 for cultural resources, which may also provide protection for paleontological resources in close proximity to the parcels. With consideration of these protections, potential effects on paleontological resources of scientific interest would be avoided or mitigated.

AIB-11 Fluid Minerals

How would future potential development of the nominated lease parcels affect fluid minerals and energy production?

There are currently 1.9 million acres of federal mineral estate leased within the MGFAA (including 1.8 million in the FFO planning area and 75,000 in the RPFO planning area). Annual production within the MGFAA is currently estimated to be 5,979,536 bbl of oil and 464,709,382 thousand cubic feet (mcf) of gas (Crocker and Glover 2018, 2019). Reasonably foreseeable environmental trends and planned actions (see Section 3.3) would result in potential for development of 3,400 oil and gas wells. Depending on the success of oil and gas well drilling, non-renewable natural gas and/or oil would be extracted and delivered to market. Development of all 3,400 wells would produce 288,040,400 bbl of oil and 5,087,456,000 mcf of gas over 20 years (Crocker and Glover 2018, 2019). This development (which includes the nominated lease parcels) is consistent with various laws, including FLPMA, 43 United States Code (U.S.C.) § 1701 *et seq.*, that mandates that the BLM administer the exploration and development of these mineral resources on public lands for the benefit of the citizens of the United States.

Future potential development of the nominated lease parcels would include 102.1 acres of surface disturbance and would add 6,179.02 acres (a 0.13% increase) to the total amount of the 4.8 million-acre MGFAA analysis area that is leased. The total future estimated production from the nominated lease parcels across the two sales (March and June 2019) is 1,695,000 bbl of oil and 22,877,000 mcf of gas (see Table 3.1) and would contribute an additional 28.3% oil and 6% gas production annually within the analysis area. Future potential development of the nominated lease parcels (sixteen wells) would comprise 0.04% of all past and reasonably foreseeable future oil and gas development (41,619 wells) and depending on the success of oil and gas well drilling, non-renewable natural gas and/or oil would be extracted and delivered to market.

None of the nominated lease parcels contain oil and gas wells, however, oil and gas activity exist within a five-mile radius of all parcels.

AIB-12 Livestock Grazing

How would future potential development of the nominated lease parcels impact livestock grazing?

The 4.8 million-acre MGFAA has experienced a loss of forage across the grazing allotments within the analysis area. Within the MGFAA, reasonably foreseeable environmental trends and planned actions would add to past and present disturbance, resulting in a total of 157,250 acres of surface disturbance over the next 20 years. Surface disturbance would involve vegetation removal and changes to forage conditions. Additionally, alterations to the existing range improvements are also possible; consequently, this would be a long-term effect.

Reasonably foreseeable cumulative actions within the MGFAA would result in a total of 25,660 acres of new surface disturbance for a total of 157,250 acres of total landscape-level surface disturbance (see Table 3.2). Proposed vegetation treatments and reclamation projects may offset surface disturbance as new forage for livestock grazing is made available through revegetation.

Eleven of the nominated lease parcels are located within grazing allotments (Table 3.10). Future potential development of these 11 nominated lease parcels would comprise approximately 102.1 acres of surface disturbance (0.06% of total landscape-level surface disturbance within the MGFAA). This surface disturbance would contribute to reduced forage availability, which would affect grazing success. Surface

disturbance for future potential development of each nominated lease parcel would affect between 0.01% to 0.21% of the allotments they intersect.

Table 3.9 Grazing Allotments by Parcel

Grazing Allotment(s)	Parcel Number(s) (parcel acreage within grazing allotment) *	Estimated Area of Surface Disturbance (acres)	Percent of Grazing Allotment that Would be Disturbed
Counselor Community No. 06015 100,734.24 acres	024 (640 acres), 026 (40 acres)	13.7	0.01%
Kimbeto Community No. 06013 103,498.11 acres	033 (160 acres) 037 (160 acres)	11.2	0.01%
Petrified Forest No. 05079 4,387.55 acres	038 (320 acres)[10]	4.35	0.10%
Sweetwater No. 05080 4,593.94 acres	039 (640.02 acres)[11]	4.35	0.10%
Blanco Navajo Community No. 05078 10,209.46 acres	039 (482.83 acres)	4.35	0.04%
Gallegos - Carson Community No. 06004 38,164.18 acres	040 (80 acres), 041 (160 acres), 042 (240 acres)	20.55	0.05%
Rancho Largo No. 05119 77,660.72 acres	047 (160 acres)	6.85	0.01%
Woodfill No. 6117 3,280.24 acres	06-025 (160 acres)	6.85	0.21%

Note: The analysis contained in this EA generally provides percentage contribution rounded to two decimal points. As such, percentages may not always sum to 100 because of rounding.

* Acreages contained in the table above were calculated using GIS data sets for resources and parcels which may differ slightly from the acreages contained in the parcel acreage within grazing allotments. Difference in total acres between parcels can vary because of geoprocessing operations where slivers of area are created when two or more data sets intersect. Any inaccuracies are negligible and do not change the overall impact analysis conclusions presented in this EA.

The BLM's authority under standard lease terms and conditions would allow for the application of measures, including relocating wells up to 200 m (656 feet), to mitigate livestock grazing–related impacts. The reasonably foreseeable cumulative actions described in Section 3.3 provide a quantitative overview of these actions within the MGFAA. These actions would result in a cumulative loss of forage across the allotments within the analysis area. Proposed vegetation treatments and reclamation projects would ultimately contribute to cumulatively long-term countervailing impacts as new forage for livestock grazing is made available through revegetation.

[10] Parcel 038 contains two ponds/dirt tanks (Kee and Sandoval Tank) which are also classified as freshwater ponds (see AIB-2).

[11] In instances where a parcel splits two allotments, future potential disturbance will be fully accounted for within both allotments. For example, parcel 39 is expected to result in 1 V well and 4.35 acres. The impacts will be shown to the Sweetwater and Blanco Navajo Communities allotments, for analysis purposes. The disturbance may occur in only one allotment or smaller acreage impact to the given allotments, if the development is shared between the allotments.

AIB-13 General Wildlife and Game Species

How would future potential development of the nominated lease parcels affect wildlife, including game and non-game species?

The 7.8 million-acre FFO contains populations of big-game species, including mule deer (*Odocoileus hemionus*), elk (*Cervus canadensis*), and pronghorn (*Antilocapra americana*), as well as a multitude of other non-game species. Carnivores include bobcat (*Lynx rufus*), coyote (*Canis latrans*), badger (*Meles meles*), kit fox (*Vulpes macrotis*), mountain lion (*Felis concolor*), and black bear (*Ursus americanus*) Several upland game bird species are also prevalent throughout the area including wild turkey (*Meleagris gallopavo*). The BLM FFO also contains year-round habitat for big-game species including mule deer and pronghorn. Disturbance from future potential development of the nominated lease parcels can result in the long-term loss of vegetation, burrows, and nests, and could also cause habitat loss and fragmentation and mortalities. Future potential development may also have effects on pronghorn, elk, mule deer, bobcat, coyote, badger, kit fox, mountain lion, black bear, and wild turkey, such as avoidance of areas within and near the nominated lease parcels.

Reasonably foreseeable cumulative actions within the MGFAA would add to past and present disturbance, resulting in 157,250 acres of total landscape-level surface disturbance, which would impact wildlife habitat. Past, present, and future vegetation restoration projects (outlined in Section 3.3), which include herbicide treatments and surface reclamation of well pads, roads, and caliche pits, have improved habitat availability for wildlife and big-game species. The aforementioned reclamation activities improve nesting cover for ground nesting birds, improve fawning habitat for pronghorn and mule deer, and restore proper hydrological functionality by increasing ground cover, slowing water movement across the surface, and increasing percolation where applicable. Migratory birds have also benefitted from the improved herbaceous cover associated with these vegetative treatments. It is assumed that future vegetative restoration will produce similar effects where they are implemented. Additionally, since 1990 the BLM has installed many wildlife habitat improvements within the analysis area including numerous watering developments. These habitat improvements have been implemented through the HSP funding, which is generated through the sale of a $10.00 stamp or authorization associated with hunting and fishing licenses. The BLM has also funded many of these projects through its annual budget.

Overall, the landscape habitat fragmentation and human presence could be considered long-term effects for wildlife, and potential exists for the decline in species numbers and/or use of the analysis area. Where implemented, restoration projects (outlined in Section 3.3.) would help offset disturbance to wildlife habitat. Additionally, new wildlife watering developments would have beneficial impacts related to water availability for wildlife species.

Surface disturbance associated with future potential development of the nominated lease parcels would result in approximately 102.1 acres of surface disturbance (0.0013% of the acreage in the approximately 7.8-million-acre FFO and 0.002% of the 4.8-million-acre MGFAA). The NMDGF has identified priority areas for further research within their New Mexico State Action Plan (NMDGF 2019), and these priority areas were based on big game units and not on identified migration corridors or winter range. The FFO falls within NMDGF Priority Area 3–New Mexico Northcentral landscape (deer, elk, pronghorn) (NMDGF 2019). Within this priority area, the NMDGF is currently conducting research on pronghorn, elk, and mule deer movement across this landscape. The only mapped migration corridor in New Mexico is within the FFO (which is reflected in the NMDGF state action plan for Secretarial Order 3362) and is located approximately 14.14 miles north of the nominated lease parcels (parcel 37) in Game Management Unit (GMU) 2b (NMDGF 2019). The mapped migration corridor and current research area within GMU 2b would not be impacted by the Proposed Action. Although no other migration corridors are officially mapped within the state or FFO planning area, the Lindrith area is within known migration routes for

mule deer; therefore, migration routes are known to occur within proximity of the nominated lease sale parcels (Sawyer 2021).

GMUs are subdivisions used to manage big game species in the state. These GMUs are designated and mapped by the NMDGF and are readily available through its annual hunting proclamation (NMDGF 2024) and website.[12] The NMDGF has provided a set of guidelines that are useful to guide oil and gas development statewide. Specifically, these guidelines can be applied in areas where potential conflicts occur between development and the various wildlife species present (NMDGF 2007).

The nominated parcels (37-39 and 47) would comprise approximately 1,762.85 acres (0.34%) of GMU 2c (which totals 516,405.99 acres); 160 acres (parcel 06-25) (.11%) of GMU 5a (146,317.57 acres), and 4,256.17 acres (parcels 8-9, 24, 03-25, 26, 33, and 40-46) (2.24%) of GMU 72 (189,696.08 ac). For impacts to Crow Mesa Special Designation, which parcel 47 overlaps, see AIB-24 (Special Designation). Stipulation F-4-TL would be attached to the nominated lease parcels 06-025 and 47, which would restrict the timing of construction and operation activities to avoid and minimize impacts to migrating species. Pre-disturbance surveys would be required at the time of proposed lease development in accordance with standard terms and conditions of the lease, as well as lease notice F-41-LN (see Appendix B). The surveys would analyze potential effects on game and non-game species habitat. Avoidance, minimization, and/or mitigation measures would also be determined at that time. The BLM has the authority under standard terms and conditions to attach COAs at the site-specific level to minimize significant adverse effects on resource values at the time operations are proposed. Examples of potential mitigation measures include implementing design modifications to avoid or minimize effects on sensitive habitats, limiting the number of well pads under simultaneous construction, incorporating seasonal restrictions, limiting the number of proposed roads, reclaiming old and/or unnecessary roads, minimizing truck traffic, implementing noise-buffering measures, conducting pre-development surveys, or using special construction techniques to minimize surface disturbance to sensitive areas.

AIB-14 Forestry and Fuelwood

How would future potential development of the nominated lease parcel impact forestry and fuelwood resources?

Forest woodland community types in the planning area are pinyon-juniper, oak woodlands, and ponderosa pine-mixed conifer. In total, these communities cover approximately 1,018,100 acres, or 47% of the FFO planning area (BLM and BIA 2020). Although timber sales are not active in FFO, forest products such as firewood, Christmas trees, wildlings, wood posts and poles, and pinyon nuts can be harvested from these areas unless otherwise closed for the protection of other resources (BLM 2003; BLM and BIA 2020). One of the primary goals of the forestry management in the FFO planning area is to protect and improve the conditions of existing ponderosa pine forests through cutting or burning the encroaching pinyon and juniper (BLM 2003).

Reasonably foreseeable environmental trends and planned actions would continue to effect forest resiliency and conditions through direct vegetation removal, human population growth and the accompanying threat of wildfire, and introduction of invasive species (BLM and BIA 2020). These effects, in turn, may affect the amount of forest products available for harvest.

The nominated lease parcels include approximately 304.36 acres of forested habitat consisting of pinyon-juniper and ponderosa pine woodlands (see AIB-5). Lease parcels 0037, 0038 (southern half), 0039, and 0047 are in areas open to fuelwood harvest. Onshore orders, lease terms, best management practices

[12] http://www.wildlife.state.nm.us/hunting/maps/big-game-unit-maps-pdfs/

(BMPs), and site-specific conditions (applied at the time of proposed lease development) would help protect fuelwood resources and avoid desirable timber species such as ponderosa pine. Voluntary proponent design features and BMPs within the FFO typically provide for pinyon pine and juniper tree species 3 inches or greater in diameter at ground level to be cut and de-limbed and stacked along access roads for wood gatherers. However, parcels which occur on BLM-managed lands are not within areas open to fuelwood harvesting, thus areas managed for this resource would not be impacted.

AIB-15 Fuels and Fire Management

How would future potential development of the nominated lease parcel impact fuels and fire management?

Reasonably foreseeable environmental trends and planned actions would continue to effect fire management within the FFO planning area through increased population growth, desertification and decreased precipitation, and the introduction and spread of invasive species that can increase fuel loading.

Future potential development of the lease parcel could result in new surface disturbance (estimated to be around 102.1 acres). Noxious and invasive weeds (including cheatgrass [*Bromus tectorum*]) readily invade disturbed sites. The potential spread of cheatgrass could provide an opportunity for increased fine fuel loading and an environment conducive to wildland fires. However, as discussed under AIB-6, the BLM's authority under Section 6 of the standard lease terms and conditions would result in the application of measures to reduce or eliminate the spread of noxious and invasive weeds.

AIB-16 Visual Resources

How would the visual landscape be affected by future potential development of the nominated lease parcel?

Distinctive features within the MGFAA include steep and colorful escarpments, broad vistas, rugged canyons, and pastel-colored badlands dissected into plateaus and pinnacles. Sagebrush and grassland expanses are prominent in the central and southern portion of the MGFAA. Pinyon-juniper woodlands, rivers, and human-made structures, such as reservoirs, roads, and oil and gas wells, dominate the northern portion (BLM 2015). Within the MGFAA, reasonably foreseeable environmental trends and planned actions would add to past and present disturbance, resulting in a total of 157,250 acres of surface disturbance, leading to visual contrasts with the surrounding landscape and adversely contributing to the existing scenic quality effects on the MGFAA's landscapes. The degree of effect would depend on the location of proposed infrastructure relative to sensitive viewsheds and areas already highly modified in character. At the landscape level, vegetation rehabilitation efforts such as Restore New Mexico would continue to help offset negative effects on visual resources by plugging and reclaiming existing and active wells to their former visual conditions.

Visual resources on BLM lands are managed using four visual resource management (VRM) classes: VRM Classes I, II, III, and IV (BLM 1986). Oil and gas development is not compatible with VRM Class I designated areas, is often not compatible with VRM Class II designated areas, is generally compatible with VRM Class III designated areas, and is compatible with VRM Class IV designated areas (BLM 1986).

Three of the nominated lease parcels (parcels 037, 038 (partially), and 039, 1,602.85 acres collectively) are located on BLM managed surface lands and are entirely within VRM Class IV designated areas. The objective of this VRM class is to provide for management activities which require major modification of the existing character of the landscape. Within this VRM class, the level of change to the characteristic

landscape can be high, and management activities may dominate the view and be the major focus of viewer attention (BLM 1986). However, the BLM will make every attempt to minimize the effect of these activities through careful location, minimal disturbance, and repeating the basic elements (BLM 1986).

One parcel, parcel 47, is within VRM III. The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape (BLM 1986).

Thirteen of the parcels are entirely or partially (038) located on private or tribal surface lands and therefore, are not subject to VRM classification standards.

Future potential development of the nominated lease parcels would result in approximately 102.1 acres (1.65% of total parcel acreage) of surface disturbance, and approximately sixteen wells. This disturbance comprises 0.4% of the projected surface disturbance (25,660 acres) in the oil and gas RFD scenarios, 0.08% of the total existing landscape disturbance (131,590 acres), and 0.06% of the total landscape-level surface disturbance (157,250 acres) associated with reasonably foreseeable cumulative actions within the FFO (see Table 3.2). The BLM FFO reviewed aerial photography and records of existing oil and gas development to determine if new development would have a significant visual impact. In general, the significance of a new visual element relates to its proximity to a sensitive viewpoint such as residences, with the impact lessening the farther away it is from that sensitive viewpoint. Parcels 24, 03-25, 33, 37, 40, and 45) include NSO stipulation F-44-NSO (see Table B.1 in Appendix B), which does not allow development within 660 feet of a residence (see Appendix B) is attached. Parcels 037-039, 06-25, and 047, have F-8-VRM attached, which may require additional mitigation methods such as special painting stipulations, site placement, and/or any other measures, to protect visual resources.

It is assumed that development of the nominated lease parcels could be visible from some or all of the residences located near the nominated lease parcels and immediately adjacent areas (see AIB-21). However, there is also potential for views of oil and gas development–related equipment and structures from individual residences to be obscured by intervening topography and vegetation. As the nominated parcels and surrounding area do not contain existing oil and gas infrastructure, the development of an estimated one well on or adjacent to each lease parcel would lead to a new visual element and modification of the landscape, resulting in visual impacts associated with the nominated parcels.

The presence of oil and gas development–related equipment and structures on the nominated parcels is unlikely to change the visual landscape of adjacent BLM-managed surface because of the limited scale of the proposed development (see Table 3.2).

Standard terms and conditions allow the BLM to consider further mitigation for visual resources at the time of the proposed lease development. Measures could include siting of well sites, roads, and associated infrastructure to follow the contour of the landform and mimic the lines in vegetation to screen and hide locations. In addition, per 43 C.F.R. § 3171.25(b)(2), interim reclamation (reclamation of surface disturbance not necessary for production) and final reclamation (reclamation following well plugging and abandonment) is required within 6 months of well completion and well plugging, respectively.

AIB-17 Cultural Resources

How would future potential development of the nominated lease parcels affect cultural resources?

Within the 4.8 million-acre MGFAA, 131,590 acres have already been disturbed. Surface disturbance associated with reasonably foreseeable cumulative actions within the MGFAA (25,660 acres of new surface disturbance and 157,250 acres of total landscape-level disturbance) would have the potential to impact cultural resources. Such impacts may include, but are not limited to, loss of or damage to cultural resources or contextual information (such as redistribution of cultural resources) because of the development of oil and gas facilities and related industrial development, increased vehicular traffic, unauthorized ground disturbances, inadvertent oil and produced water spills, erosion, unauthorized collection, and new audible and visual impacts. The magnitude of impacts associated with reasonably foreseeable cumulative actions would generally depend upon the location of RFD relative to the location of cultural resources and the degree to which the setting has already been affected. Effects from RFD on federal lands or with a federal nexus would require separate National Historic Preservation Act of 1966 (NHPA) processes to avoid, minimize, and/or mitigate effects on cultural resources.

For the March 2019 Oil and Gas Lease Sale, the BLM FFO conducted a records review of the New Mexico Cultural Resource Information System, internal BLM data sources, Navajo Nation Heritage and Historic Preservation Department (NNHHPD) records, and General Land Office records for the lease parcels to identify historic properties and other cultural resources with traditional religious and cultural significance within the area of potential effects (APE) for the lease sale. The March 2019 records review was completed for 22[13] parcels totaling 7,010 acres. The APE for physical effects is the physical footprint of the parcel boundaries + 0.25 mile buffer. The APE for audible and visual effects is the physical footprint of the parcels plus a 1.25-mile buffer, to account for any potential development that may occur within the parcels or within 1.25 miles of the parcels at the APD stage.

Of the parcels still under consideration (14), approximately 9,004 acres (11%) of 79,507 total acres of the parcels' APE have been previously surveyed for cultural resources. The records search identified 370 previously recorded historic properties. Seventy-eight (21%) of these were located within the physical APE of the lease parcels and 292 (79%) were located within a 1-mile buffer of the physical APE. Of the 370 historic properties located within the lease parcels' APE, 140 (38%) sites have been determined eligible for listing to the National Register of Historic Places; 74 (20%) have been determined not eligible, 156 (42%) are undetermined or lack data. The probability of identifying previously unrecorded historic properties in this area is high. In addition to the recorded historic properties there are 25 known Navajo Nation TCPs; and potentially eligible for the National Register of Historic Places, if evaluated.

For the June 2019 Oil and Gas Lease Sale, the BLM FFO conducted a records review of the New Mexico Cultural Resource Information System, internal BLM data sources, NNHHPD and BLM General Land Office records for the lease parcels to identify historic properties and other cultural resources with traditional religious and cultural significance within the area of potential effects (APE) for the lease sale. The June 2019 records review was completed for two parcels, totaling 320 acres. The APE for physical effects is the physical footprint of the parcel boundaries + a 0.25-mile buffer (1,202 acres collectively). The APE for audible and visual effects is the physical footprint of the parcels plus a 1.25-mile buffer (9,777 acres collectively), to account for any potential development that may occur within the parcels or within 1.25 miles of the parcels at the APD stage.

The literature review identified approximately 2,039 acres (20.86%) of 9,777 total acres of the parcels' APE have been previously surveyed for cultural resources. The records search identified 192 previously recorded historic properties. Fourteen (7%) of these were located within the physical APE of the lease parcels and 178 (93%) were located within a 1-mile buffer of the physical APE. Of the 192 historic properties located within the lease parcels' APE, 62 (32%) have been determined eligible for listing to the National Register of Historic Places; 17 (9%) have been determined not eligible, 113 (59%) are

[13] Note that only 14 of the parcels are now under consideration.

undetermined or lack data. The probability of identifying previously unrecorded historic properties in this area is high. In addition to the recorded historic properties there are 72 known Navajo Nation TCPs; and potentially eligible for the National Register of Historic Places, if evaluated.

The nominated lease parcels assessed within this EA have been assigned the National WO-NHPA Lease Stipulation, and Lease Notice NM-11-LN. In addition, leases 024, 03-25, and 026 are attached lease Stipulation F-39-NSO. With the application of Stipulation F-39-NSO to parcels, future development of the parcels may proceed in such a way as to avoid known cultural resource values and/or traditional cultural properties in areas not already within ACECs. The National WO-NHPA Lease Stipulation requires additional cultural resources analyses pursuant to Section 106 of the NHPA including identification, effects assessment, consultation, and if necessary, resolution of significant adverse effects, prior to the authorization of any ground-disturbing activities associated with the oil and gas lease. Lease Notice NM-11-LN requires compliance with Section 106 of the NHPA and Executive Order 13007 (see Appendix B). In effect, this lease notice notifies lessees that the BLM could require intensive cultural resource inventories, Tribal consultation, and mitigation measures to avoid adverse effects—the costs for which would be borne by the lessee—and that the BLM may require modifications to authorize activities that are likely to adversely affect TCPs or sacred sites for which no mitigation measures are possible. Such measures could include the development of COAs to protect cultural resources. The BLM would work with consulting parties, including any tribes or pueblos that might attach religious and cultural significance to properties within the APE, to identify additional historic properties when an APD is received and may develop COAs to mitigate physical, audible, or visual impacts to sensitive cultural resources. The processing constitutes a separate undertaking that would be analyzed through the NHPA Section 106 process at that time.

Because the proposed oil and gas lease sale does not directly authorize ground disturbance, and future oil and gas development would constitute a new undertaking that would require a separate analysis under Section 106 of the NHPA, the BLM FFO determined there would be no adverse effect on historic properties as defined in 36 C.F.R. § 800.5(b) as a result of the proposed lease sale. The FFO sent letters notifying the New Mexico State Historic Preservation Office (SHPO) and the Navajo Nation Tribal Historic Preservation Office (THPO) of their intent to use the 36 C.F.R. Part 800 regulations on December 11, 2018, as part of the BLM FFO March 2019 Competitive Oil and Gas Lease Sale planning process; and on January 25, 2019 for the June 2019 Competitive Oil and Gas Lease Sale planning process, see Section 4.3 for additional details.

AIB-18 Native American Concerns

How would future potential development on the nominated lease parcels impact Native American concerns?

Currently 131,590 acres of surface disturbance are within the 4.8 million-acre MGFAA, which makes up most of the New Mexico portion of the San Juan Basin. Surface disturbance associated with reasonably foreseeable environmental trends and planned oil and gas operations within the MGFAA (25,660 acres of new surface disturbance and 157,250 acres of total landscape-level disturbance) have the potential to adversely impact TCPs and religious properties within the vicinity. Such impacts may include, but are not limited to, temporary or long-term loss of or damage to Native American religious use or gathering areas, or loss of access to these areas because of the development of oil and gas facilities and related industrial development, increased vehicular traffic, unauthorized ground disturbances, inadvertent oil and produced water spills, or erosion. The magnitude of impacts associated with reasonably foreseeable cumulative actions would generally depend upon the location of RFD relative to areas of concern to Native American

tribes. RFD on federal lands or with a federal nexus would undergo the same type of consultation process discussed above (see AIB-17). In addition, the BLM could apply COAs to protect such properties, which may affect or limit oil and gas development. Through tribal consultation, such measures may include COAs to mitigate audible and visual impacts to sensitive TCPs. The processing of lease development applications is a separate undertaking that would be analyzed through the Section 106 process at that time, as directed by law, regulation, and policy.

The BLM FFO initiated government-to-government consultation under NEPA and NHPA for the nominated lease parcels for auction in the BLM FFO March 2019 Competitive Oil and Gas Lease Sale. A letter inviting government-to-government consultation with the BLM FFO was sent on October 12, 2018, to each of the various Pueblos and Tribes listed in Section 4.2 of this EA. On February 15, 2019, the BLM sent the Literature Review to Acoma Pueblo, All Pueblo Council of Governors (APCG), Archaeology Southwest, Counselor Chapter, Hopi Tribe, Isleta Pueblo, NNHHPD, Ojo Encino Chapter, San Felipe Pueblo, SHPO, and Torreon Chapter, per requests. The BLM received correspondence back from Acoma, Hopi, San Felipe, Isleta, Ojo Encino, NNHHPD, Zuni, and Archaeology Southwest. No other Tribal Governments have expressed an interest in the March 2019 Competitive Oil and Gas Lease Sale. However, multiple Tribes and Pueblos claim affiliation with the archaeological sites and cultural landscape of the area, and the proposed parcels include areas that have the potential to be identified as places of importance. A community church was identified in parcel 03-25 through consultation. No other TCPs or listed sacred sites are known to exist in the subject parcels.

The BLM FFO initiated government-to-government consultation under NEPA and NHPA for the two nominated lease parcels for auction in the BLM FFO June 2019 Competitive Oil and Gas Lease Sale. A letter inviting government-to-government consultation with the BLM FFO was sent on January 25, 2019, to each of the various Pueblos and Tribes listed in Section 4.2 of this EA. On April 2, 2019, the Literature Review was sent to SHPO, Navajo Nation THPO and Consulting Parties. The BLM received responses from Navajo Nation, Acoma, Zuni, Southern Ute, and Hopi. Santa Clara Pueblo also requested consultation by phone. No other Tribal Governments have expressed an interest in the June 2019 Competitive Oil and Gas Lease Sale. However, multiple Tribes and Pueblos claim affiliation with the archaeological sites and cultural landscape of the area, and the proposed parcels include areas that have the potential to be identified as places of importance through past consultations with regional Tribes, Pueblos, and Chapter Houses. During consultation, a community church was identified within parcel 03-25. No other TCPs or listed sacred sites are known to exist in the subject parcels. Refer to the Tribal Consultation section (4.2) for more information.

If the nominated parcels are leased, future potential development would go through separate NEPA and NHPA processes as directed by regulation and current policy.

Potential impacts to Native American traditional, cultural, and religious concerns include, but are not limited to, short- or long-term audible and visual impacts, and increased occupancy from development on lands of traditional importance. Cultural and traditional landscapes contain values of lands such as sacred sites, traditional cultural properties, soundscape and quietude, dark skies, viewshed and air quality, and unique landscape and special ecological areas. The MGFAA is used as the analysis area for this issue because it is generally considered to be part of the Greater Chacoan landscape and is considered part of a cultural landscape which includes sacred geography, archaeological and non-archaeological sacred sites, and landscape linked to Native American tribal ancestry. In addition, current Native American populations in the area use various types of subsistence resources (such as firewood). This also can include various types of plants and other living/non-living elements. Areas of northern New Mexico, notably within the FFO planning area, contain Navajo free permits, which support subsistence grazing.

The closest nominated lease parcel (026) is located approximately 0.62 miles outside the boundary of the Chaco Culture National Historical Park withdrawal area, as defined under Public Land Order No. 7923.[14] The withdrawal area encompasses a roughly 10-mile buffer surrounding the park and major outlying sites, and all federal lands within the withdrawal area are unavailable for oil and gas leasing.

Developing oil and gas facilities on the nominated lease parcel would include construction, operations, and long-term placement of structures, and is assumed to require approximately 102.1 acres of vegetation clearing and land leveling, including access routes, for seven new wells. Visual and audible impacts to locations and areas of Native American religious and cultural importance from development on the nominated lease parcel could occur through alteration of the landscape from direct disturbance from the drilling, operation, and completion of one oil and gas well, which is predicted to cause direct physical ground surface disturbance to 102.1 acres. See AIB-16 and AIB-21 for a discussion of visual and noise impacts. Impacts on subsistence strategies from development on the nominated lease parcel could occur through alteration of the landscape and removal of vegetation from direct disturbance from the drilling, operation, and completion of seven oil and gas wells, which is predicted to cause direct physical ground surface disturbance to 102.1 acres. However, Onshore orders, lease terms, BMPs, and site-specific conditions (applied at the time of proposed lease development) would help protect fuelwood resources and avoid desirable timber species such as ponderosa pine. See AIB-5, AIB-13, and AIB-14 for a discussion of vegetation, wildlife, and forestry impacts.

Under the standard terms and conditions, the BLM has the authority to implement mitigation measures in the COAs to reasonably reduce resource impacts at the lease development stage. These could include flare shields, the type of lighting (limited to downcast lighting with covers for safety purposes only), and project alignment. Mitigation can be accomplished by applying BMPs associated with artificial lighting of well sites. The BLM has the authority to require modification to, or disapprove, development with a federal nexus if cultural resource conflicts cannot be satisfactorily resolved. This gives the BLM the authority to control future development to avoid adverse effects, including, but not limited to, those that would cause a degradation of setting and other indirect effects.

Given the small number of wells relative to the size of the nominated lease parcel, the lease stipulations that are applied, the ability to move future development by up to 800 m (2,624.67 feet), and the nature of the resources already known and expected within the parcels, future potential development (projected to be one well) can be sited to avoid possible adverse effects on Native American traditional, cultural, subsistence and religious concerns at the time of proposed lease development.

AIB-19 Human Health and Safety

How would future potential development of the nominated lease parcels contribute risks to human health and safety concerns?

Within the 4.8 million-acre MGFAA, there are 38,219 existing active well bores of all well types across all land jurisdictions (Crocker and Glover 2018, 2019). This level of development has resulted in the following public health and safety-related risks:

- occasional fire starts;
- spills of hazardous materials, hydrocarbons, produced water, or hydraulic fracturing fluid (see Appendix D) and corresponding potential contamination of air, soil, or water;

[14] The Federal Register Notice is available at: https://www.federalregister.gov/documents/2023/06/07/2023-12158/public-land-order-no-7923-for-public-lands-withdrawal-surrounding-chaco-culture-national-historical.

- exposure to naturally occurring radioactive material (NORM) in drill cuttings or produced water (see Appendix D);
- traffic congestion and collisions from commercial vehicles and heavy use;
- infrequent industrial accidents;
- presence of hydrogen sulfide (H_2S);
- or increased levels of fugitive dust particulate matter equal to or less than 10 microns in diameter (PM_{10}) 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).

See the air quality analysis in Section 3.6.1 for projected levels of criteria pollutants, HAPs, GHG emissions, and VOC and nitrogen oxide (NO_X) emissions that contribute to ozone (O_3) formation.

As discussed in AIB-1, PFAS which are very persistent in both the environment and the human body due to their inability to readily break down (EPA 2024e). PFAS persistence has been linked to bioaccumulation in both the environment and human body, which may lead to adverse effects on human health (EPA 2024m). PFAS groundwater contamination and has been recognized as a nationally significant challenge in the United States (Sunderland et al. 2018). PFAS may be used during the hydraulic fracturing process due to their stability at high temperatures and pressures and may be used in well drilling (in the form of drilling fluids), well completion, and workover operations (Gaines 2022). In addition to drilling efficiency purposes, PFAS are used as an effective method to mitigate oil spills in water. Utilization of PFAS chemicals makes up a minimal amount (less than 1%) of chemical constituents disclosed to FracFocus for hydraulic fracturing in New Mexico (FracFocus 2024). In total, 63 of the approximately 31,000 ingredient disclosures (0.01%) in 2023 were related to PFAS used in hydraulic fracturing processes in New Mexico. PFAS use in hydraulic fracturing is likely to occur in areas not associated with New Mexico's drinking water.

As further described in Section 3.6.1 and the Air Resources Technical Report (BLM 2023a), 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 that 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 on 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 2,000 m (roughly 1.25 miles) (Adgate et al. 2014; Czolowski et al. 2017; Haley et al. 2016; Kroepsch et al. 2019).

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 O_3 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 is a complex mixture of extremely small particles and liquid droplets. Particulate matter is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. Particulate matter 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 (BLM 2023a).

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

Criteria pollutants:

- Ozone (https://www.epa.gov/ground-level-ozone-pollution) (EPA 2023e)
- Particulates (https://www.epa.gov/pm-pollution/particulate-matter-pm-basics) (EPA 2023f)
- Nitrogen dioxide (https://www.epa.gov/no2-pollution/basic-information-about-no2) (EPA 2023g)
- Carbon monoxide (https://www.epa.gov/co-pollution/basic-information-about-carbon-monoxide-co-outdoor-air-pollution#Effects) (EPA 2023h)
- Lead (https://www.epa.gov/lead-air-pollution/basic-information-about-lead-air-pollution#health) (EPA 2023i)
- Sulfur dioxide (https://www.epa.gov/so2-pollution/sulfur-dioxide-basics#effects) (EPA 2023j)
- Hazardous air pollutants (https://www.epa.gov/haps/health-effects-notebook-hazardous-air-pollutants) (EPA 2023k)

While no formal human health risk assessments have been conducted specific to past and present development in the FFO planning 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 and state levels (EPA 2023h) (see Section 3.6.1.1).

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 higher for the state of New Mexico compared with the nation as a whole. For Rio Arriba County, most notably, the Hispanic population and population living in mobile homes for the state exceed national percentages by 21.5% and 22.6%, respectively (Headwaters Economics 2023a). For San Juan County, most notably, the percentage of non-white population and population living in mobile homes for the state exceed national percentages by 14% and 16.3%, respectively (Headwaters Economics 2023i). Sandoval County's indicators are similar or lower when compared to New Mexico (Headwaters Economics 2023e). Compared with the state of New Mexico, most of the indicators for populations at risk in Rio Arriba County and San Juan County are similar to or higher than state levels. The percentages of these populations at risk in Rio Arriba and San Juan County exceed those within the state of New Mexico by 14% to 23% (Headwaters Economics 2023b, 2023f). See AIB-22 for additional discussion of existing health risks for low-income and minority populations.

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 2023l).

However, each of the reasonably foreseeable cumulative 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 16 new wells for these lease sales. This is a 0.04% increase in addition to the 38,219 existing active wells. 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 mile 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). Of the sixteen nominated lease parcels, the BLM has identified existing private residences within parcels 24, 03-25, 33, 06-25, and 45; and all parcels have residences within 1.25 miles or less where residences are generally at a higher risk for experiencing air pollution effects from oil and gas development. See Table 3.11.

When authorizing development, federal and state laws, regulations, and policies 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 NMOCD requires similar spill response measures after releasing hydrocarbons, produced water, or hydraulic fracturing fluids (see the Water Support Document [BLM 2023b] for further information on spills).
- 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 H_2S 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, see the air quality analysis in Section 3.6.1 for the potential health effects of other air pollutants, including criteria pollutants, VOCs, and HAPs. See AIB-1 and AIB-2 for further information regarding potential groundwater and surface water effects and relevant regulations, stipulations, and lease notices offering protections to groundwater and surface water quality.

AIB-20 Economic Activity

What are the potential effects from oil and gas leasing and future potential development on economic activity?

The oil and gas industry has been a substantial contributor to the social setting and economic basis of the BLM FFO for decades. The oil and gas sector of the economy 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 and revenue on a sustained basis. In the 4.8 million-acre MGFAA, there are approximately 2.7 million acres of federal mineral estate. Overall development of federal fluid minerals comprises approximately 56% of total oil and gas development activities in the MGFAA.

While the act of leasing federal minerals itself would not result in social effects, subsequent development of a lease may generate impacts to communities and individuals in the vicinity of the lease. At the lease sale stage, it is unknown where, or if, development would occur in any given nominated lease parcels; 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. For example, the revenue collected from the lease sale auction is split between the U.S. Treasury and the state in which the auction is held and can be used for improvements to transportation networks and education systems. As specific types and locations of development are proposed, their effects would be analyzed and addressed at the time of the proposed lease development.

Oil and gas lease sales may contribute to employment for area residents, continued demand for oil and gas industry–related goods and services, and continued demand for support goods and services. This continued demand may contribute to stability in employment in sectors outside of the oil and gas industry. To the extent that additional oil and gas development affect recreational and tourism opportunities in the area of the nominated lease parcels, there may be related effects in these economic sectors.

AIB-21 Quality of Life

How would future potential development of the nominated lease parcels affect quality of life and residences within and adjacent to the nominated lease parcels?

The 4.8 million-acre MGFAA contains 131,590 of total landscape-level surface disturbance associated with reasonably foreseeable cumulative actions (see Table 3.2), which includes activities that generate increased human activity, traffic, noise, dust, odor, light pollution, and visual effects (see the oil and gas development summary in Appendix D). All these activities have potential to affect quality of life of nearby residences, depending on the intensity of development activities and proximity of the lease parcel to residences. Collective effects from noise, dust, odor, and light disturbance associated with reasonably foreseeable cumulative actions could affect the quality of life for residents, depending on the intensity of development activities and proximity to residences.

For oil and gas development specifically, the distance at which residents may experience quality of life effects from increased human activity, traffic, noise, dust, odor, light pollution, and visual effects depends on a multitude of environmental factors which vary geographically (e.g., topography, landscape, and land use) and temporally (e.g., phase of development, time of day, meteorological conditions), making it inexact to predict the spatial extent of potential quality of life 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 quality of life effects on human populations. However, monitoring studies have found that residents living within approximately 0.5 mile or less of oil and gas wells (at varying stages of development) experienced nuisance levels of noise (≥50 A-weighted decibels or ≥60 C-weighted decibels) with residents less than 1,000 feet away experiencing the greatest effects (Blair et al. 2018; Hays et al. 2017; Kroepsch et al. 2019); residents living within 0.5 mile of oil and gas wells experienced nuisance levels of odors (Adgate et al. 2014.); and residents living within 1.25 miles or less experienced greater risk of air pollution effects (including, but not limited to, dust) than those living beyond 1.25 miles (Adgate et al. 2014; Czolowski et al. 2017; Haley et al. 2016; Kroepsch et

al. 2019). As described in AIB-16, the presence of oil and gas development–related equipment and structures on the nominated parcels is unlikely to change the visual landscape because of the limited scale of the proposed development (see Table 3.1).

Future potential development of the nominated lease parcels would comprise approximately 102.1 acres of surface disturbance (0.4% of the projected surface disturbance in the oil and gas RFD scenarios and 0.08% of the total existing landscape disturbance in the MGFAA analysis area) and sixteen wells. All nominated lease parcels are in rural, sparsely populated areas containing sporadically concentrated oil and gas development. Residences that are 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 mile 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). Of the sixteen nominated lease parcels, the BLM has identified existing private residences (within parcels 24, 03-25, 33, 06-25, and 45 and all parcels have residences within 1.25 miles or less where residences are generally at a higher risk for experiencing air pollution effects from oil and gas development. While most effects on the nearest residences would be short term and would cease during operations (e.g., increased human activity, traffic, noise, dust, and odor during construction, drilling, completion, and interim reclamation phases), the residences would continue to experience long-term visual or other effects that have potential to affect quality of life (see AIB-16 and AIB-19).

Table 3.11 Residences within or near the nominated lease parcels

Nominated Lease Parcel	Residences within a parcel or closest residence
024 (640)	Many residences within parcel (~31 structures)
03-025 (640)	Many residences within parcel (~22 structures)
026 (40)	None within. Closest structure outside is 1 mile to the west.
033 (160)	Many residences within parcel (~9 structures)
037 (160)	None within. Closest structure is 0.3 miles to northeast and southeast.
038 (320)	None within. Closest structure is one mile northeast.
039 (1,122.85)	None within. Closest structure is 0.3 miles west.
040 (80)	None within. Closest structure is 0.5 miles east.
041 (160)	None within. Closest structure is 0.8 miles west.
042 (240)	None within. Closest structure is 1.1 miles northwest.
043 (709.29)	None within. Closest structure is 0.84 miles southwest.
044 (712.28)	None within. Closest structure is 0.38 miles west.
045 (714.6)	Many residences within parcel (~3 structures). Closest structure outside is 0.5 miles to the northwest.
046 (160)	None within. Closest structure outside is 0.43 miles to the west.
06-025 (160)	One residence within.
047 (160)	None within. Closest structure outside is 1 mile to the west.

With consideration of total lease acreage, topography, and other resource issues 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 the residences to minimize quality of life issues. Under the authority granted in standard terms and conditions attached to each lease, measures to reduce

effects on or avoid resource values, land uses, or users would be attached as COAs to the 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 cumulative actions, effects on quality of life 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 effect as needed.

AIB-22 Environmental Justice

What are the potential effects from oil and gas leasing and future potential development on environmental justice (EJ) populations?

Environmental justice (EJ) refers to the fair treatment and meaningful involvement of people of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, programs, and policies (CEQ 1997). Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 16, 1994), requires federal agencies to determine whether proposed actions would have disproportionately high and adverse environmental impacts to minority, low-income, and American Indian populations of concern. BLM policy, as contained in BLM Land Use Planning Handbook H-1601-1 (BLM 2005: Appendix C), provides direction on how to fulfill agency responsibilities for Executive Order 12898.

The 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 minority and low-income EJ populations using Census data. The BLM's IM 2022-059, titled *Environmental Justice Implementation* and issued on September 20, 2022 (BLM 2022f), builds upon CEQ's guidance and provides further direction for considering EJ concerns in BLM-prepared NEPA documents, including a detailed framework for identifying EJ populations using Census data as well as several other recommended data sources (BLM 2022f).

The analysis area for EJ comprises Rio Arriba, Sandoval and San Juan Counties, which represents the maximum anticipated extent of potential effects (e.g., air quality, water use) associated with future potential development of the nominated lease sale parcels. This analysis area is intended to represent all communities that could be affected by future potential development of the lease parcels, either directly or indirectly.

Rio Arriba County has a population of 40,347, with 5.8% of the population under the age of 5 and 20.2% of the population over the age of 65 (Headwaters Economics 2023c). Median household income is $52,031, with 60% of the population between the ages of 16 and 64 participating in the labor force and an unemployment rate of 3.4% (Headwaters Economics 2023c, 2023d).

Sandoval County has a population of 147,327, with 5% of the population under the age of 5 and 18.8% of the population over the age of 65 (Headwaters Economics 2023g). Median household income is $76,424, with 73.6% of the population between the ages of 16 and 64 participating in the labor force and an unemployment rate of 3.6% (Headwaters Economics 2023g, 2023h).

San Juan County has a population of 122,912, with 6% of the population under the age of 5 and 15.7% of the population over the age of 65 (Headwaters Economics 2023k). Median household income is $50,734, with 64.6% of the population between the ages of 16 and 64 participating in the labor force and an unemployment rate of 4.2% (Headwaters Economics 2023k, 2023l).

Within the analysis area, individual counties, census tracts, and census-mapped places (i.e., individual cities and towns) are the geographic units of analysis used for gathering information about low-income and minority populations. There are 81 census tracts and 102 census-mapped places within the analysis area (see Figure E.1 in Appendix E). The state of New Mexico is used as the reference area for determining whether minority or low-income EJ populations exist within the county, census tracts, or census-mapped places.

The BLM defines low-income populations as individuals or groups of people whose income is less than or equal to twice (200% of) the federal poverty threshold, as identified by the U.S. Census Bureau (BLM 2022g). Minority populations include the following population groups: American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, Black or African American, some other race (other than White), a combination of two or more races, or Hispanic or Latino (BLM 2022g; CEQ 1997). Except for White non-Hispanics, all other racial and ethnic groups are considered minorities; therefore, the total minority population of an area is calculated by subtracting the White non-Hispanic population from the total population (BLM 2022g).

Members of tribal populations include all persons having origins in any of the original peoples of North America and South America (including Central America), and who maintain tribal affiliation or community attachment. Any American Indian or Alaska Native population qualifies as a tribal population, and membership in a federally recognized tribe is not required (BLM 2022g). All tribal populations qualify as EJ populations, regardless of the percentage of the analysis area population they constitute. In addition, dispersed tribal populations can also constitute EJ populations if they do not reside within the analysis area but depend on cultural resources or places located on BLM-managed land within the analysis area.

Based on the percentage of the analysis area population that constitutes a low-income, minority, or tribal population, the BLM uses the following five criteria to identify EJ populations (BLM 2022g):

1. The low-income population of the analysis area is the same or greater than that of the reference area.
2. The low-income population of the analysis area is 50% or more of the total analysis area population.
3. The minority population of the analysis area is meaningfully greater than that of the reference area (i.e., 110% or more of reference area population).
4. The minority population of the analysis area is 50% or more of the total analysis area population.
5. Tribal populations are present within the analysis area.

After examining the most recently available data on minority and low-income populations for the analysis area and reference areas (U.S. Census Bureau 2022a–2022c), the BLM has determined that there are both low-income and minority EJ communities of concern present in the analysis area. Data concerning low-income and minority communities of concern identified within the analysis area are presented in Table E.1 of Appendix E. Tribal populations that reside, or rely on resources, within the analysis area also constitute communities of concern within the analysis area and are identified in AIB-18 (Native American Concerns) and Section 4.2 (Tribal Consultation). The BLM will consult with these tribal populations as part of government-to-government consultation under NEPA and NHPA.

All counties in the analysis area meet the criteria for both minority and low-income communities of concern. Thirty-nine census tracts in the analysis meet the criteria for minority communities of concern and over 72% (56 census tracts) meet the criteria for low-income communities of concern (see Table E.1 in Appendix E). Of the 102 census-mapped places in the analysis area, 55% meet the criteria for minority

(56 places) and over 84% meet the criteria for low-income (86 places) communities of concern. When combined, all but 11 census-mapped places in the analysis area meet the criteria for either a low-income or minority community of concern (see Table E.1 in Appendix E).

The analysis area includes several types of populations who are at risk, or populations who are more likely to experience adverse health outcomes because of demographic or socioeconomic factors (Headwaters Economics 2023b, 2023f, 2023j). As described in AIB-19 (Human Health and Safety), most of the indicators for populations at risk in Rio Arriba and San Juan Counties are similar to or higher than state levels. Certain indicators are noticeably higher than those for the state of New Mexico; these include the Hispanic population, the non-white (all other races) population, and the population living in mobile homes for Rio Arriba County and the non-white (all other races) population, population that does not work, and families below poverty for San Juan County. Indicators for Sandoval County were lower than those for the state of New Mexico. The percentages of these populations at risk in Rio Arriba and San Juan Counties exceed those within the state of New Mexico by 20% to 23% and 5.2%-16.3%, respectively (Headwaters Economics 2023b, 2023f, 2023j).

While the determination 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 EJ populations. The BLM realizes that additional adverse impacts may be identified by local communities as specific development locations and types are proposed. Therefore, the BLM would provide EJ communities of concern with opportunities to identify any perceived adverse environmental impacts at the time of site-specific analysis during the APD stage. As a result, the following discussion assesses only the effects of the issues identified by the BLM during scoping associated with this leasing process. The BLM issued a press release for the March and June 2019 lease sale comment period (October 2024) in Spanish in an effort to target public involvement from Hispanic or Latino communities of concern within the analysis area. The BLM will continue to work with potentially affected communities of concern to identify and address additional EJ issues as they arise.

The BLM cannot predict where oil and gas reserves may exist on each lease parcel. Consequently, there may be instances where oil and gas exploration activities disproportionately and adversely affect EJ communities of concern because of proximity and other factors, and for variable amounts of time. For example, a typical well averages 30 to 60 days from the start of drilling to completion (see Appendix D) and may have a greater effect (increased dust, traffic, etc.) on nearby resident populations while the drilling operations are ongoing. These types of exploration activities may result in adverse impacts to EJ communities of concern located near the drilling operations; 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. Once site specific proposals (APDs) are received the BLM FFO may approve them contingent on stipulations attached at the lease sale and COA to the permit. Thus, the BLM FFO uses stipulations and COAs to minimize impacts to nearby populations, including EJ communities of concern, during construction and operations.

For purposes of the proposed leasing action, Table 3.12 provides a summary of the resource analyses presented in Sections 3.5 and 3.6 that would have potential to affect EJ communities of concern. Those conclusions were then assessed by the BLM relative to whether the projected impacts to EJ communities of concern may be adverse and disproportionate. As stated in AIB-21 (Quality of Life), the BLM has identified existing private residences within parcels 24, 03-25, 33, 06-25, and 45, and all parcels have residences within 1.25 miles or less where residences are generally at a higher risk for experiencing air pollution effects from oil and gas development. Lands surrounding the nominated lease parcels are characterized as rural and sparsely populated with existing oil and gas development. 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. During consultation, a community church was identified within parcel 03-25. No other resources of significance were identified during public scoping, and no specific Native American resource concerns have been identified on other nominated lease parcels; however, this consultation is considered ongoing.

Table 3.1012 Summary Comparison of Conclusions from Analysis of Other Issues to Environmental Justice

Issues Analyzed	Summary of Potential Significant Adverse Effects	Are potential effects disproportionate to environmental justice communities of concern?
Air Quality (Issue 1, Section 3.6.1)	Criteria pollutant, VOC, and HAP emissions would increase as shown in Section 3.6.1.2. Future potential development of the lease parcels would result in short-term local area increases of pollutant emissions, particularly fugitive dust ($PM_{2.5}$ or PM_{10}), lasting an average of 30 to 60 days.	There is potential for disproportionate impacts to EJ communities of concern. Fugitive dust and diesel exhaust emissions from construction would result in criteria pollutant, VOC, and HAP emissions. These emissions would be short term (30–60 days) and would have the greatest impact at locations near the construction activities (1.25 miles or less). Therefore, residents near the construction activities would experience greater levels of impacts because of project construction. Multiple parcels (see Table 3.11) have residences that occur within the parcel boundary, and multiple parcels remaining have residences within 1.25 miles or less. Air pollution and associated health effects (as described in Section 3.6.1) can disproportionately affect individuals within EJ communities of concern in the analysis area who are already socially vulnerable and have greater difficulty accessing healthcare facilities and paying for medical treatment or have a higher likelihood of having pre-existing health conditions (EPA 2021b). Additional review would be conducted at the time of the proposed lease development if development occurs; standard design features and project specific COAs would help to minimize potential effects that could be adverse and disproportionate to EJ populations.
Greenhouse Gases and Climate Change (Issue 2, Section 3.6.2)	Based on a 100-year global warming potential (GWP), future potential development of the nominated lease parcels is estimated to result in 0.279 megatonnes of carbon dioxide equivalent (CO_2e) over the life of the leases (see Section 3.6.2.2). All GHG emissions would contribute to global GHG emissions. GHG emissions are associated with documented ongoing and reasonably foreseeable climate-related effects. For the Upper Rio Grande Basin (southern Colorado to central-southern New Mexico), these may include increased temperatures, decreases in overall water availability, and increases in frequency, intensity, and duration of both droughts and floods (BLM 2023a).	There is potential for disproportionate impacts to EJ communities of concern. While any climate change–related effect 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 disproportionately affect individuals within communities of concern in the analysis area who are already socially vulnerable and have a lower capacity to prepare for, cope with, and recover from climate change impacts, including higher temperatures, decreased overall water availability, or increased flooding (EPA 2021b).
Water Use and Quantity (AIB-1, AIB-2, and Issue 3, Section 3.6.3)	Drilling and completion of 11 horizontal and three vertical wells on the nominated lease parcels are estimated to use approximately 64.53 acre-feet (AF) of water. Assuming that all wells are developed in the same year, this would increase the annual demand for groundwater and surface water in the analysis area by 0.0004% at current usage rates. With consideration of design features and regulatory requirements, no effects on groundwater or surface water quality are expected from well drilling and completion. Spills affecting groundwater or surface waters could occur.	There is potential for disproportionate impacts to EJ communities of concern. While groundwater resources are regional in nature and water withdrawals are not anticipated to affect domestic water sources, 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 use. BMPs and COAs would help to minimize this risk. Should a spill occur, the BLM would work with the NMOCD to immediately remediate spills in accordance with federal and state standards, including NMAC 19.15.29.11.

Issues Analyzed	Summary of Potential Significant Adverse Effects	Are potential effects disproportionate to environmental justice communities of concern?
Quality of Life (AIB-21)	Future potential development of the nominated lease parcels could result in localized air, noise, visual resources, and traffic and safety effects that could affect quality of life for local residences and EJ populations, particularly during construction. Continued expansion of the oil and gas industry can have a negative effect on the quality of life for people who value undeveloped landscapes.	There is potential for disproportionate impacts to EJ communities of concern. In general, quality of life impacts would be greater for the residents near the future potential development (1.25 miles or less). Multiple parcels (see Table 3.11) have residences that occur within the parcel boundary, and multiple parcels remaining have residences within 1.25 miles or less. When evaluating placement of wells at the lease development stage, standard design features and project specific COAs would be applied to reduce effects that could be adverse and disproportionate to communities of concern.
Human Health and Safety (AIB-19)	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. Other health and safety risks may include occasional fire starts; spills of hazardous materials and corresponding potential contamination of air, soil, or water; exposure to NORM; traffic collisions; and presence of H_2S. The magnitude of effects on human populations would depend on the frequency, timing, and levels of contact with potential stressors. After wells are properly plugged and reclaimed, they would no longer contribute to human health and safety risks; however, some public health effects from air pollution may endure beyond the lives of the wells (e.g., chronic respiratory problems such as asthma).	There is potential for disproportionate impacts to EJ communities of concern. In general, health and safety impacts would be greater for the residents near the future potential development (1.25 miles or less). Multiple parcels (see Table 3.11) have residences that occur within the parcel boundary, and multiple parcels remaining have residences within 1.25 miles or less. Communities of concern within the analysis area include several types of populations at risk who are more likely to experience adverse health outcomes because of demographic or socioeconomic factors including ethnicity and housing conditions (Headwaters Economics 2023b, 2023f, 2023j). Therefore, the communities of concern within the analysis area may be more sensitive to the effects of air pollution and other health and safety risks associated with future potential development of the lease parcels, relative to non-EJ communities. An additional review of potential human health and safety risks would be conducted at the time of proposed lease development. Standard terms and conditions attached as COAs to the APD could include measures to reduce health and safety effects on nearby communities of concern. Future potential development would be subject to relevant rules and regulations regarding public health and safety.

An additional review would be conducted at the time of proposed lease development. Standard terms and conditions attached as COAs to the APD could include measures to reduce effects on nearby EJ communities of concern. Under the Oil and Gas Leasing Regulation for Surface Use Rights, such reasonable measures may include modification to siting or design of facilities, including relocation of proposed operations up to 200 m (656 feet). 43 C.F.R. § 3101-1-2. These measures may minimize potentially significant adverse effects (e.g., from dust or visual/audio effects) on members of EJ communities of concern.

AIB-23 Recreation and Special Designations

How would future potential development of the nominated lease parcel impact recreation and special designations within and near the nominated lease parcels?

Recreation activities within the 7.8-million-acre FFO include camping, hiking, hunting, shooting, fishing, nature viewing, sightseeing, horseback riding, mountain biking, and motorized recreation including off-highway travel (on existing maintained or primitive roads), and off-road travel (cross-country, off existing roads). Off-highway vehicle use has increased in popularity as more versatile vehicles have become affordable and available. Noted recreation attractions within the FFO include Chaco Culture National Historical Park (CCNHP), which attract tourists from New Mexico and beyond. Special designations,

such as off highway vehicle (OHV[15]) areas, special management areas (SMAs),[16] special recreation management areas (SRMAs),[17] and areas of environmental concern (ACECs) are found throughout the FFO, and provide general recreational opportunities, are for locations with special management concerns, or are areas that require explicit recreation management. Additionally, there are several wildlife areas throughout the state of New Mexico; these areas are managed specifically for wildlife, recreation, and hunting opportunities. Oil and gas–related and other surface disturbances have the potential to modify special designations, recreation opportunities, and the recreation experience over the long term, primarily as a result of changes in the landscape (viewshed), soundscape (noise), habitat loss, and presence of oil and gas development–related activities (construction, traffic, etc.). Within the FFO, reasonably foreseeable cumulative actions would add to past and present disturbance, resulting in a total of 157,250 acres of surface disturbance over the next 20 years. This comprises 2% of the FFO. Some of the past impacts have been mitigated through vegetation restoration projects and surface reclamation of well pads, roads, and facility sites.

It is estimated that 102.1 acres would be disturbed as a result of future potential development of all nominated lease parcels; this comprises 0.06% of total landscape-level surface disturbance (157,250 acres; see Table 3.2) associated with reasonably foreseeable cumulative actions. Oil and gas development–related equipment and structures would be present in the areas of development. This disturbance is unlikely to change overall special designations and dispersed recreation opportunities or the experience of dispersed recreation because of the limited scale of the proposed development and the presence of substantial existing oil and gas development (see Table 3.1). There may be some small increases in access for dispersed recreation because of new roads.

Six nominated lease parcels are located within or close to special designation areas (Table 3.13). Surface disturbance of future potential development of these six nominated lease parcels is expected to directly impact approximately 6.85 acres (associated with parcel 47) of the special designation areas that intersect the parcels listed in Table 3.13. Visual and noise effects of oil and gas development from all the nominated lease parcels are unlikely to change the visual landscape and soundscape, as these effects are consistent with the surrounding landscape, which is already highly modified in character (see AIB-16).

None of the nominated lease parcels are adjacent to the boundary of CCNHP. The nearest nominated lease parcels to the boundary of CCNHP is parcel 026 which is approximately 10.62 miles northeast of the CCNHP. As such, future potential development of the nominated lease parcels is not expected to impact access, dispersed recreation, or noise for CCNHP beyond existing conditions. See AIB-16 and AIB-17, for more information regarding visual impacts and economic activity impacts to CCNHP and recreation.

[15] OHV areas are allowed throughout the FFO planning area and includes any motor vehicle that may travel over land. There are several OHV designated areas throughout the FFO planning area. OHVs are used in general recreation for the transport of recreational visitors, but they may also provide recreational activities themselves in the form of motorcycle and ATV pursuits.

[16] SMAs are locations with specialized management concerns or needs that do not necessarily warrant an Area of Critical Environmental Concern designation. Generally, SMAs contain resources or opportunities that require a level of management narrowly focused on a localized resource or resource use concern. SMAs are considered land use authorization avoidance areas because they contain resource values that pose special constraints for, and can result in denial of, applications for land uses that cannot be designed to be compatible with management objectives and prescriptions. A variety of supporting management activities may be used to implement the management prescriptions. These generally include posting boundaries, installing information signs, conducting an inventory and monitoring resources and their uses, acquiring access where appropriate, acquiring additional lands from willing parties as necessary to meet management objectives, and resolving unauthorized uses.

[17] SRMAs are areas requiring explicit recreation management to achieve BLM's recreation objectives and to provide specific recreation opportunities. The BLM’s recreation investments are concentrated in these areas.

Table 3.13. Existing and Proposed Special Designations and Special Management Areas within Five Miles of the Leases

Special Designation or Management Area (total acres or miles)	Values Contributing to Special Designation	Closest Lease Parcel	Potential Impacts
Pretty Woman ACEC (ACEC009046) – 84 acres	Cultural Resource Values	Parcel 038 – ACEC is 1.4 miles southeast of parcel.	Depending on the specific location of future potential development, vegetation clearing and construction of oil and gas facilities within or adjacent to lease could contribute similar visual and noise effects outside of, but that may be seen or heard from within the ACEC but would not result in direct disturbance.
Bi Yaazh ACEC (ACEC009077) – 75 acres	Cultural Resource Values	Parcel 047 – ACEC is 2.57 miles northeast of parcel.	Depending on the specific location of future potential development, vegetation clearing and construction of oil and gas facilities within or adjacent to lease could contribute similar visual and noise effects outside of, but that may be seen or heard from within the ACEC but would not result in direct disturbance.
Old Spanish Trail National Historic Trail (NHT) - Approximately 200 miles of the trail occurs within the FFO planning area, of which approximately 73 miles are on BLM-administered land.	The Old Spanish trail which was designated as an NHT by Congress in 2002, is a 2,700-mile-long trail that was historically used as a pack route for traders, slavers, trappers, and immigrants travelling between Santa Fe, New Mexico and Los Angeles, California. It likely followed older Native American trail routes in some areas and portions that had been used by earlier Spanish exploring and trading ventures (BLM 2015).	Parcel 03-25 – located 3.79 miles northeast of the trail.	The Old Spanish NHT is located within approximately 3.79 miles of the nominated lease sale parcels. The closest nominated lease parcel (03-25) is located approximately 3.79 miles northeast of the NHT. Future potential development of the nominated lease sale parcels would result in approximately 102.1 acres of surface disturbance. Although the trail does not directly intersect any of the nominated lease parcels, the trail could be indirectly affected through changes to the landscape (viewshed), soundscape (noise), and the presence of oil and gas development–related activities (construction, traffic, etc.). As described in AIB-21, studies have found that noise and odor effects tend to be greatest within approximately 0.5 mile or less of oil and gas wells and air quality effects (e.g., dust) tend to be greatest within 1.25 miles or less (Adgate et al. 2014; Czolowski et al. 2017; Haley et al. 2016; Kroepsch et al. 2019). Therefore, given the distance between the NHT and nominated lease sale parcels, the trail is not likely to experience these types of non-visual effects. While the long-term presence of oil and gas development on the nominated lease parcels has the potential to be visible from the NHT (see AIB-16), there is also potential for views of oil and gas development–related equipment and structures from the NHT to be obscured by intervening topography and vegetation. The presence of oil and gas development–related equipment and structures on the nominated parcels is unlikely to change the Old Spanish NHT's historic or recreational values because of the limited scale of the proposed development and the presence of existing oil and gas development in the region. With consideration of total lease acreage, topography, and other resource issues present within the nominated lease parcels, there are opportunities for future potential development to reasonably be placed in portions of the nominated lease parcels that are less proximal to the NHT to minimize visual impacts. Understandard terms and conditions attached to each lease, measures to reduce or avoid effects on the NHT would be attached as COAs to the 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 visual or light effects during construction and operations.

Special Designation or Management Area (total acres or miles)	Values Contributing to Special Designation	Closest Lease Parcel	Potential Impacts
Bisti/De-Na-Zin Wilderness (45,000 ac.)	Badlands landscape, rock formations, fossils.	Parcel 42 (directly adjacent northern border of the wilderness area. Parcels 40 and 41 range from 1.25 to 1.5 miles from the northern boundary.	Depending on the specific location of future potential development of parcels 40-42, vegetation clearing and construction of oil and gas facilities within or adjacent to lease could contribute similar visual and noise effects outside of, but that may be seen or heard from within the Wilderness Area but would not result in direct disturbance. The future development could affect the wilderness experience of visitors within the northern portion of the Bisti/De-Na-Zin Wilderness. Oil and gas infrastructure and operations from these lease parcels, especially parcel 42, could generate sights and sounds that intrude on the natural qualities and sense of solitude within the wilderness area.
Crow Mesa SDA (34,200 acres)	Wildlife	Parcel 47 (almost fully within - all except 0.45 acres of parcel). Parcels 37-39 range from of 1-2.5 miles from the SDA boundary.	Parcel 47 overlaps Crow Mesa SDA entirely. Vegetation clearing and construction of oil and gas facilities within could contribute visual and noise effects and would result in direct disturbance. To prevent impacts to wildlife, stipulations F-4-TL and lease notice F-41-LN are attached to the parcel. In addition, a POD would be required before surface disturbance would be allowed. The future potential development of parcel 47 is expected to result in 6.85 acres of disturbance, or 0.02% of the SDA.

Land with Wilderness Characteristics Unit 210-069 (5,900 ac.)	Naturalness	038 (within)	Nominated lease parcel 38 contains 320 acres consisting of 160 private surface acres and 160 BLM surface acres. Approximately 110 acres of the BLM-managed portion of the parcel intersects with the LWC. One well is predicted to be drilled within this parcel resulting in approximately 4.35 acres of surface disturbance. This future potential well and associated surface disturbance may occur on the portion of the parcel overlapping the LWC Unit, the portion of the parcel that falls on non-wilderness character BLM-managed lands in the southern portion of the parcel, or on private surface in the northern portion of the parcel. If future potential development were to occur outside of the LWC Unit, the wilderness character designation criteria of this area would consequently be unaltered by development. If future potential development were to occur within the boundary of the LWC Unit, development activities and surface disturbances are forecasted to likely result in the loss of wilderness character on 4.35 acres of the LWC Unit (or 0.07% of the LWC Unit's 5,900-acre total area). The influence of future potential development on the area's wilderness characteristics may be reduced through the application of COAs (e.g., placement and/or height of development features, paint color requirements) at the time of proposed lease development activities (which would require site-specific NEPA analysis) based on the BLM's authority under standard lease terms and conditions. A BLM choice to lease nominated lease parcel 38 would not preclude or curtail the wilderness characteristics of the LWC Unit based on direction in BLM Manual 6310 (Conducting Wilderness Characteristics Inventory on BLM Lands [BLM 2012]). Manual 6310, under boundary delineation, indicates the following with respect to mineral leases: "*Undeveloped ROWs and similar undeveloped possessory interests (e.g., mineral leases) are not treated as impacts to wilderness characteristics because these rights may never be developed*". Further, if anticipated future potential development were to occur within the portion of the parcel that overlaps the LWC Unit, 99.93% of the LWC Unit would continue to be unaltered by human influence. As a result, this portion of the LWC Unit would continue to retain its wilderness characteristics and future potential development would not preclude BLM options to manage this portion of the LWC Unit for the protection of its wilderness characteristics in the future. There are no documented past or present actions that have deleterious effects on the wilderness characteristics of the LWC Unit as recently (2016) inventoried and documented (the current 5,900-acre LWC Unit). However, at this time nearly 100% of the LWC Unit is already leased. As a result, it is possible (i.e., a reasonably foreseeable future action) for an APD (or APDs) to be submitted in the future by industry for disturbance related development on leases covering other portions of the LWC Unit. If development of already leased parcels that fall within the boundary of the LWC Unit were to occur, they would likely contribute to the loss of the LWC Unit's wilderness characteristics through the surface disturbing activities that accompany development. This situation exists irrespective of BLM's decision to lease or not lease parcel 38 because industry already retains development rights to the parcels that cover other portions of the LWC Unit. Effects associated specifically with leasing and future potential development of parcel 38 would likely constitute the loss of the

Special Designation or Management Area (total acres or miles)	Values Contributing to Special Designation	Closest Lease Parcel	Potential Impacts
			wilderness characteristics of the LWC Unit on approximately 4.35 acres (or 0.07%) of the LWC Unit. This is the estimated incremental contribution of leasing and future potential development of parcel 38 to the loss of wilderness characteristics within the LWC Unit.

Note – parcel 039 intersects an area proposed by New Mexico Wilderness Alliance (NMWA) as and LWC, however, the BLM has not identified the NMWA-proposed area as an LWC unit.

AIB-24 Night Skies/Dark Environments

How would future potential development of the lease parcels affect the quality of night skies and dark environments at the Chaco Culture National Historical Park?

Night Sky and Dark Environments are considered one of the critical features protected by CCNHP. The natural photic environment, unencumbered by light pollution, is critical to ecosystem function, as well as providing both natural aesthetic and experiential qualities to park visitors. In 2013, Chaco Culture NHP was certified as an International Dark Sky Park. Night sky measurements were collected from 2001-2016 using photographic equipment configured by the NPS Night Skies Program. Three measures were used as an indicator for sky glow which is the brightening of the night sky that results from light pollution. Zenith Limiting Magnitude (ZLM) was measured at 7.0 under most conditions. A ZLM of 6.3 usually indicates significantly degraded sky quality. A ZLM of 6.6 is considered near pristine under average conditions. Bortle Sky Classification was Class 3: rural sky, based on the visibility of astronomical objects. The scale ranges from class 1, the darkest skies available on Earth, through class 9, inner-city skies. Zenith Sky Brightness ranged from 21.72 to 22.23 mag arcsec-2. Overall, Night Sky condition at CCNHP is considered "good".

The main sources of sky glow in the analysis area are the light domes from Albuquerque, Bloomfield, Crownpoint, Farmington, Gallup, Grants, Rio Rancho, and Santa Fe. These light domes were observable along the horizon with a few exceeding the brightness of the Milky Way. Additionally, glare sources from oil and gas development sites are observable along the north and east horizons. The artificial lighting from oil and gas development is associated with infrastructure lighting, flaring, and traffic. At present, approximately 38,219 active well bores of all well types are in the MGFAA (see Table 3.2). Surface disturbance associated with reasonably foreseeable cumulative actions within the FFO (25,660 acres of new surface disturbance, for a total of 157,250 acres of total landscape-level surface disturbance) would likely contribute to sky glow over the long term with an incremental increase as wells are developed. Past and reasonably foreseeable cumulative actions would result in a total of 41,619 wells. While NPS monitoring data indicate that dark sky conditions in the area currently retain their natural characteristics, SQI ratings could be affected by sky glow associated with community and urban growth, as well as oil and gas well development associated with reasonably foreseeable cumulative actions.

Future potential development of the nominated lease parcels would result in 102.1 acres of surface disturbance and sixteen wells, which would represent 0.04% of the 41,619 wells associated with past and reasonably foreseeable cumulative actions (see Table 3.2). Future potential development of the nominated lease parcels could introduce additional artificial lighting that would contribute to sky glow over the short and long term. The degree to which artificial lighting contributes to sky glow would be generally temporary and transient in nature and would vary based on conditions such as cloud cover, weather, and wind speed or direction. For example, most artificial lighting would be short term and would occur during

the drilling, completion, and potential flaring of a well, which could last for approximately 30 to 60 days. Long-term lighting sources from oil and gas development and production include those associated with vehicle traffic as well as safety lighting required at night. There is wide variability in both types of lighting and potential impacts of that lighting on night skies that are dependent on environmental factors best understood at the site-specific development stage. Because site-specific information such as the average number of lumens per well or proposed lighting plans for each proposed development is not known at the leasing stage, the number of proposed wells and anticipated new surface disturbance is used as the proxy for determining the change in oil and gas–related lighting from existing conditions (currently estimated at 38,219 active wells and 131,590 acres of related surface disturbance; see Section 3.3.1). Given that the NPS reports that the primary sources that contribute to an increase in night sky effects (sky glow) are cities (NPS 2016a), contributions to sky glow from future potential development of the nominated lease parcels (sixteen wells; 102.1 acres of surface disturbance) would be a small contribution to the existing sources (a 0.04% increase over current number of wells and a 0.08% increase in oil and gas–related surface disturbance). Nominated lease parcel 033 is 13.56 miles northeast of, and most proximal to, the CCNHP night sky monitoring sites (in this instance, the Gallo Cuesta site), while parcel 026 is approximately 10.62 miles northeast, and most proximal to, the CCNHP boundary.
Under standard terms and conditions, the BLM has the authority to require mitigation measures to reasonably reduce resource effects at the lease development level. The BLM may require mitigation measures that specify lighting plans prepared by a qualified lighting designer which may include flare shields, alternatives to lighting, outdoor luminaires certified to minimize light pollution including appropriate warm color temperature, controls to limit unnecessary lighting such as timers and/or motion sensors, and project alignment.

3.6 ISSUES ANALYZED IN DETAIL

The issues identified for detailed analysis in this EA were developed in accordance with CEQ regulations and the guidelines set forth in the BLM NEPA Handbook H-1790-1 (BLM 2008b) using input from internal and external scoping. Issues were retained for detailed analysis if that analysis is necessary to make a reasoned choice between alternatives, to determine significance, if there is disagreement about the best way to use a resource, or if there is conflict between resource impacts or uses.

3.6.1 Issue 1: Air Quality

How would future potential development of the nominated lease parcels affect air quality (particularly National Ambient Air Quality Standards and volatile organic compounds) in the analysis area?

Air quality is determined by the quantity and chemistry of atmospheric pollutants in consideration of meteorological factors (i.e., weather patterns) and topography, both of which influence the dispersion and concentration of those pollutants. The presence of air pollutants is generally due to a number of different and widespread sources of emissions.

The analysis area for this issue is the entirety of San Juan, Sandoval, Rio Arriba, and McKinley Counties, which make up the New Mexico portion of the San Juan Basin. This spatial scope of analysis was identified based on the regional nature of air pollution and to facilitate analysis using the best available air quality data, which are generally provided at the county level. For the purposes of this analysis, short-term effects on air quality are considered those that cease after well construction and completion (30–60 days); long-term effects are considered those associated with operations and production and would cease after operations/production are concluded.

Much of the information in this section is incorporated from the *BLM Air Resources Technical Report for Oil and Gas Development in New Mexico, Oklahoma, Texas, and Kansas* (herein referred to as Air Resources Technical Report (ARTR) and incorporated into this EA by reference) (BLM 2023a).

3.6.1.1 *Affected Environment*

The Clean Air Act (CAA) requires the EPA to set NAAQS for six criteria air pollutants considered harmful to public health and the environment: CO; NO_2; O_3; particulate matter (PM_{10} and $PM_{2.5}$); SO_2; and lead (Pb). NO_x and VOC emissions also contribute to secondarily formed pollutants of O_3 and $PM_{2.5}$ through a complex series of atmospheric chemical interactions. The CAA categorizes NAAQS as "primary" or "secondary." Primary standards provide public health protection, including the health of at-risk populations, with an adequate margin of safety (EPA 2024a), and secondary standards provide for public welfare, including protection against degraded visibility and damage to animals, crops, vegetation, and buildings (EPA 2024a). A detailed description of these pollutants, along with their health effects and their sources, can be found in Chapter 3 of the ARTR (BLM 2023a).

Compliance with the NAAQS is typically demonstrated through monitoring of ground-level concentrations of atmospheric air pollutants. Areas where pollutant concentrations are below the NAAQS are designated as attainment or unclassifiable. Locations where monitored pollutant concentrations are higher than the NAAQS are designated nonattainment, and air quality is considered unhealthy. All of the planning area is in attainment or unclassified for each of the NAAQS; however, air monitoring data show that 3-year average O_3 concentrations in the planning area are within 95% of the 8-hour O_3 NAAQS. Pursuant to New Mexico Statute 74-2-5.3, if the NMED determines that emissions from sources within its jurisdiction cause or contribute to O_3 concentrations in excess of 95% of a national ambient air quality standard for O_3, it shall adopt a plan, including regulations, to control emissions of oxides of nitrogen and VOCs to provide for attainment and maintenance of the standard. The NMED has initiated an Ozone Attainment Initiative to address O_3 levels in the area (NMED 2024a). To address NOx and VOC emissions, New Mexico's EMNRD published the New Mexico Oil Conservation Division Statewide Natural Gas Capture Requirements (Waste Prevention Rule), NMAC 19.15.27, on May 25, 2001, and NMED developed the "*Oil and Natural Gas Regulation for Ozone Precursors*," NMAC 20.2.50, published on July 26, 2022, with an effective date of August 5, 2022. Additional information on these two regulations can be found in Section 2.6 of the ARTR, incorporated by reference.

The EPA has delegated the responsibility of regulation and enforcement of the NAAQS to the NMED and has approved the New Mexico State Implementation Plan, which allows the State of New Mexico to enforce both the New Mexico Ambient Air Quality Standards (NMAAQS) and the NAAQS on all federal and private lands with the exception of tribal lands and lands within Bernalillo County (NMED 2024b). Tribal lands under EPA jurisdiction follow the Federal Implementation Plan for the *Indian Country Minor New Source Review Program for the Oil and Gas Industry* (80 Federal Register 51991). Air pollutant concentrations are reported using design values. Design values are statistics that describe the air quality in any given area relative to the NAAQS levels. Design values are used to designate and classify nonattainment areas, as well as to assess progress toward meeting the NAAQS. The EPA's Air Quality Design Values webpage lists the Design Value Reports used for making NAAQS and NMAAQS compliance determinations (EPA 2024b). Design values that are representative of the impact analysis area are provided in Table 3.14. It is assumed that counties without reported design values have good air quality and pollutant concentrations are below the NAAQS. The main pollutants of concern are O_3, $PM_{2.5}$, and PM_{10} as these are the pollutants with reported design values nearest the NAAQS. While no current $PM_{2.5}$ monitors are located within the Proposed Action area, previous annual monitoring of $PM_{2.5}$ in San Juan County resulted in design values of 4.7 ug/m^3 (2011-2013), 4.5 ug/m^3 (2012-2014), and 4.1 ug/m^3 (2013- 2015) (BLM 2023a). These values are below the new NAAQS of 9.0 ug/m^3. PM10 design values are only available and presented as average estimated exceedances for each county. EPA data for San

Juan County in the years 2020 through 2023 show three average estimated exceedances of the 1987 24-hour PM10 NAAQS. Although exceedances are presented, the information listed in this PM10 design value report is intended for informational use only and does not constitute a regulatory determination by the EPA as to whether an area has attained a NAAQS and the area is still designated as attainment.

Table 3.14. Design Values Compared with NAAQS and NMAAQS for Counties within the Analysis Area

Pollutant	2023 Design Concentrations	Averaging Time	NAAQS	NMAAQS
CO	La Plata County, Colorado: Ute 1 at 0.7 ppm, Ute 3 at 0.3 ppm	8-hour	9 ppm	–
CO	La Plata County, Colorado: Ute 1 at 1.8 ppm, Ute 3 at 2.9 ppm	1-hour	35 ppm	–
O_3	Rio Arriba County: 0.063 ppm Sandoval County: 0.067 ppm San Juan County: 0.070 ppm: four stations; Bloomfield at 0.065 ppm, Navajo Dam at 0.070 ppm, Shiprock at 0.067 ppm, Chaco Culture National Historical Park (NHP) at 0.067 ppm	8-hour*	0.070 ppm	–
NO_2	San Juan County: 9 ppb, four stations; Bloomfield at 9 ppb, Navajo Dam at 6 ppb, Chaco Culture NHP at 1 ppb, and Shiprock at 2 ppb	Annual†	53 ppb	50 ppb
NO_2	San Juan County: 33 ppb, four stations; Bloomfield at 33 ppb, Navajo Dam at 22 ppb, Chaco Culture NHP at 4 ppb, Shiprock at 20 ppb	1-hour‡	100 ppb	–
SO_2	San Juan County: 8 ppb: two stations; Bloomfield 1 ppb, Shiprock at 4 ppb	1-hour§	75 ppb	–
$PM_{2.5}$	Taos County: 4.9 µg/m^3	Annual †,**	9 µg/m^3	–
$PM_{2.5}$	Taos County: 15 µg/m^3	24-hour‡,**	35 µg/m^3	
PM_{10}	San Juan County: 3	24-hour†,**	150 µg/m^3, not to be exceeded more than once per year on average over 3 years	–

Source: EPA (2024a, 2024b)

ppm = parts per million, ppb = parts per billion, µg/m^3 = micrograms per cubic meter

* Annual fourth highest daily maximum 8-hour concentration, averaged over 3 years.

† Not to be exceeded during the year.

‡ 98th percentile, averaged over 3 years.

§ 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years.

** Annual mean averaged over 3 years.

3.6.1.2 *Air Quality Related Values*

The prevention of significant deterioration (PSD) is a CAA permitting program for new or modified major sources of air pollution located in attainment areas. It is designed to prevent NAAQS violations, preserve and protect air quality in sensitive areas, and protect public health and welfare (EPA 2023a). Under PSD regulations, the EPA classifies airsheds as Class I, Class II, or Class III. The CAA PSD requirements give more stringent air quality and visibility protection to national parks and wilderness areas that are designated as Class I areas, but a PSD designation does not prevent emissions increases. Federal land managers are responsible for defining specific AQRVs, including visual air quality (haze), and acid (nitrogen and sulfur) deposition, for an area and for establishing the criteria to determine an adverse impact on the AQRVs. The nearest Class I areas are Mesa Verde National Park to the north, San

Pedro Parks Wilderness Area and Bandelier Wilderness Area to the southeast and Petrified National Park to the southwest. The analysis area is in attainment for the NAAQS and the NMAAQS and is categorized as a Class II area (EPA 2024b NMED 2024c). This project is not subject to PSD analysis or permitting.

As required by the Regional Haze Rule, reasonable progress goals must provide for an improvement in visibility for the 20 percent most anthropogenically impaired days relative to baseline visibility conditions and ensure no degradation in visibility for the 20 percent clearest days relative to baseline visibility conditions (EPA 2019). Model simulations were used to project visibility by using the baseline for each Class I area as the average visibility (in deciviews [dv]) for the years 2014 through 2017. The visibility conditions in these years are the benchmark for the "provide for an improvement" and "no degradation" requirements. A line drawn between the end of the 2014-2017 baseline period and 2064 (dv/year) shows a uniform rate of progress or "glidepath" between these two points. The glidepath represents a linear or uniform rate of progress and is the amount of visibility improvement needed in each implementation period to stay on the glidepath; there is no rule requirement to be on or below the glidepath. Results for the nearest Class I areas to the analysis area shows improving trends for both the base (2014-2017) and future year (2028) deciview values on the 20% clearest and most impaired days. More information can be found in the *Technical Support Document for EPA's Updated 2028 Regional Haze Modeling* (EPA 2019), incorporated by reference. Visibility extinction trends based on air monitoring data from the IMPROVE monitors in the BLM New Mexico State Office area of responsibility show that visibility trends have been flat or improving (Figures 9 through 20 of the ARTR [BLM 2023a]). Specifically, visibility trends shown for San Pedro Parks, Mesa Verde, and Weminuche indicate that visibility on the best days has been flat to improving and that visibility on worst days has shown little change over the period of record. Based on the current monitoring and projected 2028 modeled data, the Class I areas within the analysis area are on track for meeting the visibility and light performance requirement for the 2064 end point. Implementation of Best Available Retrofit Technology (BART) strategies as required under the federal Regional Haze Rule over the next few years should result in further improvements (BLM 2023a).

The National Park Service (NPS) monitors and evaluates deposition to determine which parks are most at risk from air pollution and where conditions are declining or improving. Nitrogen deposition conditions in NPS-managed areas near the project area are generally fair to good with no trend for improving or worsening conditions, while sulfur deposition conditions are fair to good and generally improving (where trend data are available) (Table 3.15) (NPS 2024).

Table 3.15. Nitrogen and Sulfur Deposition Conditions at NPS-Managed Areas in/near New Mexico

Class I Areas	**Nitrogen (Conditions / Trend)**	**Sulfur (Conditions / Trend)**
Bandelier National Monument	Fair / Relatively unchanging trend	Good / Improving trend
Mesa Verde National Park	Fair / Relatively unchanging trend	Good / Improving trend
Petrified Forest National Park	Poor / Relatively unchanging trend	Good / Improving trend
Other Class II Areas	**Nitrogen (Conditions / Trend)**	**Sulfur (Conditions / Trend)**
Aztec Ruins National Monument	Good / Trend not available	Good / Trend not available
Canyon de Chelly National Monument	Fair / Trend not available	Good / Trend not available
Chaco Culture National Historic Park	Fair / Trend not available	Good / Trend not available
El Malpais National Monument	Fair / Trend not available	Good / Trend not available

El Morro National Monument	Fair / Trend not available	Good / Trend not available
Manhattan Project National Historical Park	Poor / Trend not available	Fair / Trend not available
Petroglyph National Monument	Poor / Trend not available	Good / Trend not available
Valles Caldera National Preserve	Fair / Trend not available	Good / Trend not available

Sources: NPS (2024).

Note: Only areas with air monitoring equipment are reported in this table.

3.6.1.3 *Criteria Pollutant Emissions within the Analysis Area*

Along with criteria pollutant concentrations as measured by air monitors, the EPA provides data on criteria pollutant emissions, expressed in tons per year or total volume of pollutant released into the atmosphere. Emissions data point to which industries and/or practices are contributing the most to the general level of pollution (BLM 2023a). Emissions associated with industry and other anthropogenic practices within the FFO are primarily the result of electrical power generation, oil and gas development, vehicles (highway and off-highway traffic), and other industrial activities (EPA 2023b, BLM 2023a).

The NMED compiles statewide emission inventories to assess the level of pollutants released into the air from various sources. The 2020 National Emissions Inventory (NEI) data for the state of New Mexico and San Juan, Sandoval, Rio Arriba, and McKinley Counties (four counties in the FFO) are listed in Table 3.16 (EPA 2023b). Sources of criteria air pollutants in the analysis area are two coal-fired electrical generation units: the San Juan Generating Station 15 miles west of Farmington, New Mexico which was closed in September 2022, and the Four Corners Power Plant on the Navajo Nation near Fruitland, New Mexico (BLM 2023a; EPA 2023b).

Table 3.16. 2020 NEI Air Pollutant Emissions for San Juan, Sandoval, Rio Arriba, and McKinley Counties and for the State of New Mexico

Source of Data	Emissions (tons per year)						
	PM_{10}	$PM_{2.5}$	VOC	NO_X	CO	SO_2	HAPs
2020 NEI – San Juan, Sandoval, Rio Arriba, and McKinley Counties*	24,218	6,042	141,794	53,708	108,755	2,301	15,278
2020 NEI – State of New Mexico	129,132	42,623	712,639	199,462	615,513	87,828	105,528

Source: EPA (2023b).

HAPs = hazardous air pollutants

Note: BLM now reports both biogenic and human-caused emissions in the table above. The table above shows emissions by county, including biogenic sources. Emissions of PM_{10}, $PM_{2.5}$, and SO_2 are estimated to be solely from human-caused sources. Human-caused emissions from NO_x, CO, and VOCs are reduced to 64,404 tons, 199,676 tons, and 109,510 tons, respectively.

* 2020 data include the point, nonpoint, onroad mobile, and nonroad mobile data. Values may not always sum correctly if queried on demand as the NEI database updates its emissions periodically with newer emission information.

The largest 2020 NEI anthropogenic sources of criteria air pollutants in San Juan, Sandoval, Rio Arriba, and McKinley Counties are: oil and gas sources for CO and NO_x; area sources for PM_{10} and $PM_{2.5}$ and ammonia (NH_3); natural sources (biogenic) for VOCs; and point sources for SO_x (Table 3.17). The Area Sources category includes all area sources except biogenic (natural) sources, forest wildfires, and prescribed fires. From the period of 2008 to 2020, all source types showed a decrease in emissions except for forest wildfires and oil and gas sources. During this period, total emissions, including biogenic sources decreased from 904.146 tons (2008) to 418,097 tons (2020), and decreased 676,988 tons (2008) to 342,828 tons (2020) without biogenic sources (EPA 2008, 2023b). Additional information on the

reductions can be found in Section 12.3 of the ARTR (BLM 2023a) and has been incorporated by reference.

Table 3.17. 2020 NEI Air Pollutant Emissions for San Juan, Sandoval, Rio Arriba, and McKinley Counties, by Source

Source	Emissions (tons per year)						
	PM_{10}	$PM_{2.5}$	VOC	NO_X	CO	SO_x	NH_3
Area sources	20,805	2,989	4,571	322	2,064	34	5,605
Oil and gas sources	287	283	59,129	22,582	33,662	289	0
Nonroad mobile	128	124	737	2,978	7,469	4	2
Onroad mobile	362	193	1,763	6,826	25,162	14	146
Point sources	2,264	2,139	6,216	18,591	25,670	1,926	200
VOC refueling	-	-	924	-	-	-	-
Natural sources (biogenic)	-	-	67,639	2,336	11,304	-	-
Forest wildfires	330	279	723	64	3,039	30	51
Prescribed fires	42	35	92	9	385	4	6
San Juan, Sandoval, Rio Arriba, and McKinley Counties Total	**24,218**	**6,042**	**141,794**	**53,708**	**108,755**	**2,301**	**6,010**

Source: EPA (2023b); data extracted April 1, 2023.

3.6.1.4 *Hazardous Air Pollutants*

A pollutant is classified as a HAP if it has been identified by the EPA as a compound that is known or suspected to cause cancer or other serious health effects, such as compromises to immune and reproductive systems, birth defects, developmental disorders, and/or adverse environmental effects (BLM 2023a). There are currently 188 compounds listed as HAPs by the EPA. HAPs emitted by the oil and gas industry include benzene, toluene, ethyl benzene, mixed xylenes, formaldehyde, normal-hexane. National Emissions Standards for HAPs (NESHAPs), established by the EPA, limit the release of specified HAPs from specific industries (40 C.F.R. §§ 61, 63). NESHAPs for oil and gas development include control of benzene, toluene, ethyl benzene, mixed xylenes, and n-hexane from major sources, and benzene emissions from triethylene glycol dehydration units as area sources (BLM 2023a).

The ARTR discusses the relevance of HAPs to oil and gas development and the particular HAPs that are regulated in relation to these activities (BLM 2023a); the ARTR is specifically incorporated by reference. Potential health risks associated with HAPs released into the air from oil and gas operations have been evaluated by review of existing emissions data, air quality monitoring, and modeling studies. The ARTR discusses in detail a 2019 health assessment study for which scientists from Colorado State University conducted on-site air monitoring for 47 VOCs (including HAPs) during various stages of well development and production at oil and gas extraction facilities in Colorado. In summary, simulated cancer risks to average individuals were below one in one million at distances of 1,400 feet from the well pads, four in one million at 500 feet from the well pads, and ten in one million at 300 feet from the well pads. Fewer than one in one million people at distances of 2,000 feet from the well pads experienced the worst potential long-term combination of individual risk factors, oil and gas emissions, and local meteorological conditions (maximum exposed individual). This figure rises to seven in one million at 500 feet from the well pads, and 10 in 1 million at 400 feet from the well pads (BLM 2023a).

The Air Toxics Screening Assessment (AirToxScreen), published by the EPA, provides a screening tool for state, local, and tribal air agencies (EPA 2022a). The EPA Air Toxics Screening Assessment is used to evaluate impacts from existing HAP emissions in New Mexico. AirToxScreen is the successor to the previous National Air Toxics Assessment. In December 2022, EPA released the results of its 2019 AirToxScreen (EPA 2022a). AirToxScreen calculates concentration and risk estimates from a single year's emissions data using meteorological data for that same year. The risk estimates assume a person breathes these emissions each year over a lifetime (or approximately 70 years). AirToxScreen provides quantitative estimates of potential cancer risk and five classes of non-cancer hazards (grouped by organ/system: immunological, kidney, liver, neurological, and respiratory) associated with chronic inhalation exposure to real-world toxics for each county and census tract (BLM 2023a). AirToxScreen is a cumulative HAP assessment based on total HAP emissions from all sources contained in the NEI. Per the AirToxScreen Technical Support Document, this national-scale assessment (AirToxScreen) is consistent with EPA's definition of a cumulative risk assessment, as stated in EPA's *Framework for Cumulative Risk Assessment*, as "an analysis, characterization, and possible quantification of the combined risks to health or the environment from multiple agents or stressors" (EPA 2003; 2022b).

The 2019 AirToxScreen analysis reveals that the total cancer risk (defined as the probability of contracting cancer over the course of a 70-year lifetime, assuming continuous exposure) in San Juan, Sandoval, Rio Arriba, and McKinley Counties is 17.6, 18.7, 12.3 and 11.1 in 1 million, respectively, which is lower than the nationwide level (25.5 in 1 million) and in the same range as the state of New Mexico (19.1 in 1 million). The contribution of the oil and gas industry to the cancer risk in San Juan, Sandoval, Rio Arriba, and McKinley Counties is 2.06, 0.01, 0.04, and 0.01 in 1 million, respectively (EPA 2022a).[18] Bright lines[19] could not be used in the analysis of the HAP results to determine if a particular risk level is acceptable or not, as no such construct for risk exists within the CAA framework akin to the NAAQS (that is, there are no NAAQS against which to compare modeled HAP concentrations). Rather, values or ranges of values published by EPA (e.g., AirToxScreen [National Air Toxics Assessment] or 40 C.F.R. Part 300.430 [Remedial Investigation/Feasibility Study]) were used to provide useful context to risk estimates. While no explicit risk thresholds are available, EPA uses 1 in 1 million and 100 in 1 million risk for context (EPA 2022b). As a result, the values for San Juan, Sandoval, Rio Arriba, and McKinley Counties are within the contextual range published by the EPA. The respiratory hazard index (HI) in the analysis area (San Juan, Sandoval, Rio Arriba, and McKinley Counties) ranges from 0.28, 0.22, 0.13, and 0.12, respectively, which is lower than the national HI (0.31) and within a similar range as the New Mexico HI (0.22) (BLM 2023a). A review of the results of the 2019 AirToxScreen shows that cancer, neurological risks, and respiratory risks in the analysis area are all lower than national levels and are generally the same as the state of New Mexico (EPA 2022a).

Additional HAPs analysis was prepared in response to an adverse decision of the Tenth Circuit. Diné Citizens Against Ruining Our Env't v. Haaland, 59 F.4th 1016, 1047 (10th Cir. 2023) ("Diné CARE II").[20] The BLM Cumulative Hazardous Air Pollutants Modeling – Final Report (BLM and Ramboll 2023a) and the BLM Summary of Cumulative Oil and Gas Hazardous Air Pollutant Analysis for the FFO (BLM and Ramboll 2024), incorporated by reference and summarized below, detail the modeling methods used and the results of the modeling.

[18] A one in 1 million lifetime cancer risk is defined as for every 1 million people who are continuously exposed over 70 years to a certain level of a pollutant, one person may develop cancer (EPA 2022a).

[19] "A "bright line" in risk characterization refers to a threshold value that separates acceptable and unacceptable levels of risk. It is regarded as a clear and unambiguous limit used to determine whether a particular level of exposure to a hazardous substance is safe or not." (BLM and Ramboll 2024).

[20] The federal Clean Air Act defines a Hazardous Air Pollutant (HAP) as "any air pollutant" of which "emissions, ambient concentrations, bioaccumulation or deposition of the substance are known to cause or may reasonably be anticipated to cause adverse effects to human health or adverse environmental effect." 42 U.S.C. § 7412.

The BLM's Western United States HAP photochemical modeling assessment was prepared to support BLM's analysis of cumulative oil and gas impacts from HAPs originating from oil and gas production in Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, and Wyoming (states where the BLM commonly authorizes federal activities for fossil energy development) on public health. In regard to which HAPs to consider in the analysis, the Diné CARE II Court specifically mentioned five HAPs—benzene, toluene, ethylbenzene, mixed xylenes, and n-hexane—as applying to oil and gas development activities based on the National Emission Standards for HAPs (NESHAPs; see 43 C.F.R. Part 63). The modeling assessment evaluated emissions from existing federal, new federal, and non-federal oil and gas sources and includes six key HAPs—benzene, toluene, ethylbenzene, xylene, n-hexane, and formaldehyde—because these compounds are common in the oil and gas sector and consistent with regulatory requirements described in the Environmental Protection Agency's New Source Performance Standards, see 43 C.F.R. Part 60, and NESHAPs. HAP emissions in this study include emission sources associated with wellsite exploration, wellsite production, and midstream sources (BLM and Ramboll 2023a). The modeling analysis evaluated air quality out to a future year of 2032[21] utilizing data from the 2028 Western Regional Air Partnership (WRAP)/Western Air Quality Study (WAQS) modeling platform, the Environmental Protection Agency SPECIATE 5.14 speciation profiles, the EPA's 2016v2 emissions modeling platform (EPA 2022c), and the BLM oil and gas development projections to quantify and apportion federal and non-federal oil and gas emissions (BLM and Ramboll 2023a). The model output allows the BLM to compare concentrations of HAPs to calculated risk-based thresholds in order to provide the hard look at the effects on public health required by NEPA.

Carcinogenic and noncarcinogenic chronic risks from modeled oil and gas concentrations were calculated for the 2032 future year. As noted in the Cumulative Effects section of this EA, the Reasonably Foreseeable Development (RFD) scenarios (FFO and RPFO) for the New Mexico portion of the San Juan Basin represents a conservative projection for oil and gas production based on the number of completions occurring compared to the RFD forecast value. Health-based inhalation thresholds and cancer unit risk estimate threshold values were obtained from the weight of evidence for carcinogenicity under the 2005 EPA cancer guidelines (without revisions) (EPA 2021a). A residency exposure adjustment factor was applied to the cancer inhalation risk by multiplying the annual modeled concentration by the cancer unit risk factor and multiplying this product by an applicable exposure adjustment factor. The residency exposure adjustment factor[22] is computed by taking the average residency of the county where development is proposed (Table 3.18) and dividing that by length of exposure over an assumed 70-year life span. For example, for San Juan County, the residency exposure adjustment factor would be 15.5/70. All other values in the following tables are raw model output with no adjustment applied.

Table 3.18. County Specific Residency Information

Area	San Juan County, New Mexico	McKinley County, New Mexico	Sandoval County, New Mexico	Rio Arriba County, New Mexico	New Mexico
Years	15.5	18.5	14.1	19.8	15.9

Source: Estimate based on data from U.S. Census Bureau (USCB), 2023, 2018-2022 American Community Survey 5-Year Estimates, Table S2502 Demographic Characteristics for Occupied Housing Units, https://data.census.gov/table/ACSST5Y2022.S2502?q=S2502, accessed on December 26, 2023.

[21] EPA's 2016v2 modeling platform (EPA 2022c), the most advanced dataset at the time of model development, includes missions for the years 2016, 2023, 2026, and 2032. Future year 2032 was used in this modeling assessment. The Western Regional modeling for the FFO and RPFO included all the wells that were producing and expected to be producing up to 2032. The HAPs modeling followed the RFDs for both the FFO and the RPFO up until 2032, but total RFD production was not analyzed because of the limits of the current EPA data.

[22] EPA 2024d. Exposure Assessment Tools by Routes – Inhalation, https://www.epa.gov/expobox/exposureassessment-tools-routes-inhalation.

Table 3.19 shows the oil and gas cancer risk from federal sources (existing and new) and from all mineral designations together from the combination of benzene, ethylbenzene, and formaldehyde. The risk analysis was performed only for the three HAPs (benzene, ethylbenzene, and formaldehyde) because these pollutants had EPA-provided non-zero unit risk estimate (URE) values based on the weight of evidence approach (EPA 2021a). The non-adjusted (70-year) cancer risk from all oil and gas sources for San Juan, McKinley, Sandoval, and Rio Arriba Counties is less than 30 in a million (maximum of 27.48 in San Juan County). The maximum total oil and gas residency exposure-adjusted cancer risk for San Juan, McKinley, Sandoval, and Rio Arriba Counties, as described above, is 6.09, 0.58, 1.93, and 6.15, respectively (BLM and Ramboll 2024).

Table 3.19. Estimated Cancer Risk from 2032 Oil and Gas Production in the FFO by Mineral Designation

County	Cancer Risk* from Existing Federal Wells (per million)	Cancer Risk* from New Federal Wells (per million)	Cancer Risk* from Nonfederal Wells (per million)	70-Year Cancer Risk* from Cumulative Oil and Gas Production	Adjusted Cancer Risk** from Cumulative Oil and Gas Production
McKinley	0.04 to 0.84	0.02 to 0.55	0.05 to 0.88	0.11 to 2.21	0.03 to 0.58
Rio Arriba	0.29 to 15.51	0.13 to 2.75	0.25 to 4.27	0.67 to 21.74	0.19 to 6.15
Sandoval	0.12 to 2.76	0.07 to 3.11	0.13 to 3.91	0.32 to 9.60	0.06 to 1.93
San Juan	0.07 to 16.70	0.04 to 4.02	0.09 to 7.18	0.20 to 27.48	0.04 to 6.09

*Cancer risk from emissions of benzene, ethylbenzene, and formaldehyde.

**Adjusted residency risk based on residency factors by county (18.5 years for McKinley County, 19.8 years for Rio Arriba County, 14.1 for Sandoval County, and 15.5 for San Juan County).

Risk characterization is a description of the nature and, often, magnitude of human risk, including resulting uncertainties. Risk characterization is accomplished by integrating information from the components of the risk assessment and synthesizing an overall conclusion about risk that is complete, informative, and useful for decision makers (EPA 2000[23]). A "bright line" in risk characterization refers to a threshold value that separates acceptable and unacceptable levels of risk. It is regarded as a clear and unambiguous limit used to determine whether a particular level of exposure to a hazardous substance is safe or not.

Bright lines were not used in the analysis of the cumulative oil and gas HAPs results to determine if a particular risk level is acceptable or not, as no such construct for risk exists within the Clean Air Act framework akin to the national ambient air quality standards (that is, there are no national ambient air quality standards against which to compare modeled HAP concentrations). Rather, values or ranges of values published by EPA (e.g., AirToxScreen [National Air Toxics Assessment] or 40 C.F.R. Part 300.430 [Remedial Investigation/Feasibility Study]) were used to provide useful context to risk estimates associated with the cumulative oil and gas HAPs study. As described in the BLM Cumulative Hazardous Air Pollutants Modeling Final Report (BLM and Ramboll 2023a), while no explicit risk thresholds are available, EPA uses 1 in 1 million and 100 in 1 million risk for context (EPA 2022a; 2022b). As a result, both the 70-year cancer risk and the adjusted cancer risk in Table 3.19 are within the contextual range published by the EPA.

It is important to note that the cancer risks estimated by this assessment only consider cumulative oil and gas sources and six common oil and gas HAP pollutants. While the cumulative oil and gas contribution is within the contextual range published by EPA (1 in 1 million and 100 in 1 million), additional HAPs from

[23] EPA 2000. Science Policy Council Handbook "Risk Characterization", EPA 100-B-00-002, December 2000, https://www.epa.gov/sites/default/files/2015-10/documents/osp_risk_characterization_handbook_2000.pdf.

non-oil and gas sources could increase the overall risk in the project area. This modeling assessment looked at cumulative oil and gas sources to address the court's holding in regards to analysis of cumulative HAP emissions. It was beyond the scope of this modeling assessment to determine cumulative HAP values from non-oil and gas sources.

AirToxSreen is consistent with EPA's definition of a cumulative risk assessment. The contribution, based on EPA's most recent AirToxScreen results (2019), of the oil and gas industry to the cancer risk in San Juan, Sandoval, Rio Arriba, and McKinley Counties ranged from 0.01 to 2.06 in a million (BLM 2023a). While not paired in time, the BLM's cumulative oil and gas study showed the contribution of the oil and gas industry to cancer risk (circa 2032) in San Juan, Sandoval, Rio Arriba, and McKinley Counties ranged from 0.58 to 6.15 in a million (maximum county values) (BLM 2023a). While different methods were used by EPA and the BLM to determine cumulative oil and gas contributions and this could result in inconsistencies when comparing the data, the overall trend projects cumulative oil and gas contribution increases between 2019 and circa 2032, which could be offset by projected declines in other sectors based on increased electrification, equipment efficiency, and renewable technologies for electricity generation (EIA 2023a). To have an entirely consistent analysis between BLM and EPA would have required BLM to project the entire national emission inventory forward to a common future year (2032 in the BLM study) and use the CMAQ model with the unique chemical mechanism within CMAQ used in AirToxScreen. To BLM's knowledge, in the near 30-year history of EPA's National Air Toxics Assessment (NATA), of which AirToxScreen is part of, a future year projection for NATA has never been attempted and such an exercise would be outside the scope of this EA. Therefore, using the AirToxScreen results described above, if one were to simply add the risk values for respective counties between EPA's and BLM's modeling (would not be scientifically valid given the varying methodologies), the addition of the other source categories places the total risk from other sources in addition to future projections of HAPs impacts from oil and gas development still well within the 1 in 1 million and 100 in 1 million risk range.

Table 3.20 shows the Hazard Quotients (HQs) for each compound and the HI. EPA estimates chronic noncancer HQs by dividing a chemical's estimated long-term exposure concentration by the reference concentration for that chemical. Chronic noncancer hazards from multiple air toxics were assessed by calculating a HI through the summation of individual HAP HQs that share similar adverse health effects, resulting in a target organ-specific HI representing the risk to a specific organ or organ system. An HQ or HI value less than 1 indicates that the exposure is not likely to result in adverse noncancer effects (BLM and Ramboll 2023a; EPA 2022a, 2022b). San Juan, McKinley, Sandoval, and Rio Arriba Counties show HQ and HI values below 1 for all mineral designations, indicating that cumulative oil and gas source exposure is not likely to result in adverse noncancer effects. The maximum HI from total oil and gas production is also below 1, at 0.208, 0.017, 0.071, and 0.168, for San Juan, McKinley, Sandoval, and Rio Arriba Counties, respectively (BLM and Ramboll 2024). It is important to note that the noncancer risks estimated by this assessment only consider cumulative oil and gas sources and the six common oil and gas pollutants. While the cumulative oil and gas contribution are below 1, additional HAPs from non-oil and gas sources could increase the overall risks in the project area. This modeling assessment looked at cumulative oil and gas sources to address the court's holding in regards to analysis of cumulative HAP emissions. It was beyond the scope of this modeling assessment to determine cumulative HAP values from non-oil and gas sources.

Table 3.20. Estimated Hazard Quotients and Hazard Index from Circa 2032 Oil and Gas Production in the FFO by Mineral Designation

Source	Hazard Quotient (HQ)						Hazard Index (HI)
	Benzene	Toluene	Ethylbenzene	Xylene	n-Hexane	Formaldehyde	
McKinley County							
Existing Federal	<0.0001 to 0.0003	Range is <0.0001	Range is <0.0001	Range is <0.0001	<0.0001 to 0.0001	0.0003 to 0.0060	0.0003 to 0.0064
New Federal	<0.0001 to 0.0005	Range is <0.0001	Range is <0.0001	<0.0001 to 0.0001	<0.0001 to 0.0001	0.0001 to 0.00033	0.0002 to 0.0040
Total Federal	0.0001 to 0.0008	Range is <0.0001	Range is <0.0001	<0.0001 to 0.0001	<0.0001 to 0.0002	0.0004 to 0.0093	0.0004 to 0.0103
Non-Federal	<0.0001 to 0.0005	Range is <0.0001	Range is <0.0001	<0.0001 to 0.0001	<0.0001 to 0.0002	0.0003 to 0.0060	0.0004 to 0.0067
Total Oil and Gas	0.0001 to 0.00012	Range is <0.0001	Range is <0.0001	<0.0001 to 0.0001	<0.0001 to 0.0003	0.0007 to 0.0150	0.0008 to 0.0167
Rio Arriba County							
Existing Federal	0.0001 to 0.0046	Range is <0.0001	Range is <0.0001	<0.0001 to 0.0005	<0.0001 to 0.0021	0.0022 to 0.1130	0.0022 to 0.1230
New Federal	<0.0001 to 0.0035	Range is <0.0001	<0.0001 to 0.0001	<0.0001 to 0.0003	<0.0001 to 0.0007	0.0009 to 0.0168	0.0010 to 0.0214
Total Federal	0.0001 to 0.0071	Range is <0.0001	<0.0001 to 0.0001	<0.0001 to 0.0007	<0.0001 to 0.0022	0.0031 to 0.1271	0.0032 to 0.1372
Non-Federal	0.0001 to 0.0033	Range is <0.0001	Range is <0.0001	<0.0001 to 0.0004	<0.0001 to 0.0005	0.0019 to 0.0311	0.0019 to 0.0353
Total Oil and Gas	0.0002 to 0.0083	Range is <0.0001	<0.0001 to 0.0001	<0.0001 to 0.0009	<0.0001 to 0.0022	0.0049 to 0.1564	0.0051 to 0.1679
Sandoval County							
Existing Federal	<0.0001 to 0.0017	Range is <0.0001	Range is <0.0001	<0.0001 to 0.0002	<0.0001 to 0.0004	0.0090 to 0.0186	0.0009 to 0.0209
New Federal	<0.0001 to 0.0046	Range is <0.0001	<0.0001 to 0.0001	<0.0001 to 0.0006	<0.0001 to 0.0007	0.0005 to 0.0155	0.0005 to 0.0215
Total Federal	0.0001 to 0.0054	Range is <0.0001	<0.0001 to 0.0001	<0.0001 to 0.0007	<0.0001 to 0.0011	0.0014 to 0.0341	0.0014 to 0.0414
Non-Federal	<0.0001 to 0.0026	Range is <0.0001	<0.0001 to 0.0001	<0.0001 to 0.0003	<0.0001 to 0.0005	0.0010 to 0.0257	0.0010 to 0.0291
Total Oil and Gas	0.0001 to 0.0079	Range is <0.0001	<0.0001 to 0.0002	<0.0001 to 0.0010	<0.0001 to 0.0016	0.0024 to 0.0598	0.0024 to 0.0705
San Juan County							
Existing Federal	<0.0001 to 0.0055	Range is <0.0001	<0.0001 to 0.0001	<0.0001 to 0.0006	<0.0001 to 0.0010	0.0005 to 0.1210	0.0006 to 0.1282
New Federal	<0.0001 to 0.0050	Range is <0.0001	<0.0001 to 0.0001	<0.0001 to 0.0006	<0.0001 to 0.0008	0.0003 to 0.0220	0.0003 to 0.0285
Total Federal	<0.0001 to 0.0082	Range is <0.0001	<0.0001 to 0.0001	<0.0001 to 0.0009	<0.0001 to 0.0011	0.0008 to 0.1430	0.0008 to 0.1534
Non-Federal	<0.0001 to 0.0037	Range is <0.0001	Range is <0.0001	<0.0001 to 0.0004	<0.0001 to 0.0006	0.0006 to 0.0516	0.0006 to 0.0563
Total Oil and Gas	0.0001 to 0.0170	Range is <0.0001	<0.0001 to 0.0001	<0.0001 to 0.0012	<0.0001 to 0.0015	0.0014 to 0.1946	0.0015 to 0.2082

3.6.1.5 *Environmental Effects*

IMPACTS OF THE PROPOSED ACTION

Substantial air resource impacts are not anticipated from leasing as it is an administrative action. Any potential effects on air quality from the sale of lease parcels would occur at such time that any issued lease is 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 lease is developed.

Four general phases of post-lease development would generate air pollutant emissions: 1) well development (well site construction, well drilling, and well completion), 2) well production operations (extraction, separation, and 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 (phases 1 and 2) occur on-lease and the BLM has program authority over these activities, mid-stream and end-use emissions (phases 3 and 4) typically occur off-lease where the BLM has no program authority.

During well development, there could be emissions from earth-moving equipment, vehicle traffic, drilling, and completion activities. NO_2, SO_2, 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 NO_2 and CO emissions, with lesser amounts of SO_2. These temporary emissions would be short-term during the drilling and completion phases, which is expected to last between 30 and 60 days. During well production and operations there could be continuous emissions from separators, condensate storage tanks, flares or combustors, and daily tailpipe and fugitive dust emissions from operations traffic. During the operational phase of a well, NO_2, CO, VOC, and HAP emissions would result from the long-term use of storage tanks, pumps, separators, and other equipment. Additionally, dust (PM_{10} and $PM_{2.5}$) would be produced due to wind erosion on well pads and roads, and by vehicles servicing the well site infrastructure.

The BLM FFO emission estimates were developed from the BLM Single Oil and Gas Well Emission Inventory Tool, which covers the San Juan Basin. The BLM Single Oil and Gas Well Emission Inventory Tool uses the EPA Compilation of Air Pollutant Emissions Factors, EPA Motor Vehicle Emission Simulator, EPA Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling – Compression-Ignition, and other sources. The tool has also been modified to account for San Juan Basin gas profiles, typical project details, and recent New Mexico Department of Energy, Minerals, and Natural Resources (EMNRD) and NMED rules and regulations (Waste Prevention Rule and Ozone Precursor Rule). Production data from the IHS Markit Enerdeq database (commercial source), including an estimate of the total potential mineral yield, or EUR, and the associated decline rates were included in the BLM Single Oil and Gas Well Emission Inventory Tool. Single-well estimates and associated production data were based on horizontal drilling (Max Emissions from Oil and Gas Scenarios–Single Well Emissions in the San Juan Basin). The horizontal oil emissions were based on the deep oil with high gas scenario. The horizontally drilled single-well emissions could be used in cases when well types are unknown, such as during leasing, providing a conversative estimate for vertically drilled wells (if vertical wells were to be drilled). Whereas this information provides an estimate of emissions based on typical development occurring in New Mexico, actual emissions from the development of any given well may differ. The FFO

and RPFO are calculating project-specific emissions on a project-specific basis. Emissions estimates per well are included in Table 3.21 for the March and June lease sales.

Table 3.21. Percent Increase from Future Potential Development of the Lease Parcels – March and June Lease Sales

Fourteen Wells (March 2019 Oil and Gas Lease Sale)							
Future Potential Development	**Lease Sale Emissions (tons per year)**						
	PM_{10}	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**VOCs**	**HAPs**
Single-well construction/development phase	9.45	1.48	14.50	0.0008	3.69	1.07	0.02
Single-well operation phase	4.35	0.56	2.54	0.0013	5.75	12.19	0.49
Single-well total	13.80	2.04	17.04	0.0021	9.44	13.26	0.51
Total emissions from lease sale (Fourteen wells)	193.20	28.56	238.56	0.0294	132.16	185.64	7.14
San Juan Basin emissions*	24,218	6,042	53,708	2,301	108,755	141,794	15,277
Percent increase	0.80%	0.47%	0.44%	0.001%	0.12%	0.13%	0.05%
Two Wells (June 2019 Oil and Gas Lease Sale)							
Future Potential Development	**Lease Sale Emissions (tons per year)**						
	PM_{10}	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**VOCs**	**HAPs**
Single-well construction/development phase	9.45	1.48	14.50	0.0008	3.69	1.07	0.02
Single-well operation phase	4.35	0.56	2.54	0.0013	5.75	12.19	0.49
Single-well total	13.80	2.04	17.04	0.0021	9.44	13.26	0.51
Total emissions from lease sale (Two wells)	27.6	4.08	34.08	0.0042	18.88	26.52	1.02
San Juan Basin emissions*	24,218	6,042	53,708	2,301	108,755	141,794	15,277
Percent increase	0.11%	0.07%	0.06%	0.0002%	0.02%	0.02%	0.01%
16 Wells – Total Scenarios Combined							
Future Potential Development	**Lease Sale Emissions (tons per year)**						
	PM_{10}	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**VOCs**	**HAPs**
Single-well construction/development phase	9.45	1.48	14.50	0.0008	3.69	1.07	0.02
Single-well operation phase	4.35	0.56	2.54	0.0013	5.75	12.19	0.49
Single-well total	13.80	2.04	17.04	0.0021	9.44	13.26	0.51
Total emissions from lease sale (Sixteen wells)	220.8	32.64	272.64	0.0336	151.04	212.16	8.16
San Juan Basin emissions*	24,218	6,042	53,708	2,301	108,755	141,794	15,277
Percent increase	0.91%	0.54%	0.51%	0.001%	0.14%	0.15%	0.05%

Note: The analysis contained in this table provides percentage contribution rounded to two decimal points. The representative well used to calculate emissions is a horizontal well.

*EPA 2023b

As stated, the most substantial criteria pollutants and O_3 precursors emitted by oil and gas development and production are VOCs, HAPs, particulate matter, and NO_X. VOCs and NO_X contribute to the formation of O_3, which is the pollutant of most concern in northwestern New Mexico, and because O_3 is not a direct emission, emissions of NO_X and VOCs are used as proxies for estimating O_3 levels. Under the Proposed Action, the additional NO_X and VOC emissions (quantified in Table 3.21) from the potential wells would incrementally add to O_3 levels within the analysis area. The BLM does not predict a significant change in the number of wells drilled per year based upon this action and production in the San Juan Basin is predicted to remain at or below the forecasted RFD numbers for wells drilled per year. Based on the current rate of development (below the projected RFD) and the RFD projections compared to the Colorado Air Resources Management Modeling Study (CARMMS) 2.0 modeling (discussed in the cumulative effects section [see Section 3.6.1.9]), the corresponding CARMMS 2.0 low modeling scenario, which represents a conservative estimate of federal impacts through 2025, indicates that the emissions from this project would not be expected to result in any exceedances of the NAAQS or NMAAQS for any criteria pollutants in the analysis area.

Levels of HAPs would also temporarily increase during construction and completion activities under the Proposed Action, particularly in the form of diesel particulate matter from the on- and off-road construction equipment. However, concentrations of mobile source emissions of diesel particulate matter are typically reduced by 60% at approximately 300 feet (et al. 2002). According to Zhu et al. (2002), the ultrafine particle (diameter <100 nanometers) concentration measured at 300 m (about 985 feet) downwind from the source of emissions was indistinguishable from the upwind background concentration. The relatively steep drop-off with distance of diesel particulate matter concentrations as well as the short duration of the activity make the effects from exposure to HAP emissions minimal during construction. Additionally, a 2019 health assessment study completed by Colorado State University (ICF and Colorado State University 2019) during various stages of well development and production at oil and gas extraction facilities in Colorado found that chemical air concentrations for VOCs (including HAPs) and associated exposure levels decreased rapidly with distance. Simulated chronic cancer risks over a lifetime of exposure for average individuals were below 1 in 1 million at distances of 1,400 feet from the well pads, 4 in 1 million at 500 feet from the well pads, and 10 in 1 million at 300 feet from the well pads. Fewer than 1 in 1 million people at distances of 2,000 feet from the well pads experienced the worst potential long-term combination of individual risk factors, oil and gas emissions, and local meteorological conditions (maximum exposed individual). This figure rises to 7 in 1 million at 500 feet from the well pads, and 10 in 1 million at 400 feet from the well pads (ICF and Colorado State University 2019). Additional information related to HAPs and the Colorado State University study can be found in Section 5 of the ARTR (BLM 2023a), incorporated by reference. Additional HAP analysis may occur at the APD stage depending on well pad proximity to residences.

Construction activities would be one of the primary sources of particulate matter emissions as a result of dust and fine particles generated from on-site equipment use and related groundwork, as well as on- and off-site vehicles (Araújo et al. 2014; Reid et al. 2010). How particulate matter interacts with the environment is dependent on a variety of factors, with the size and chemical composition of the airborne particles being the most important in terms of dispersion (distance from the source) and deposition from the atmosphere. Effects of all particulate matter emissions would not be confined to the construction site because $PM_{2.5}$ (fine particles) can travel farther in terms of distance than PM_{10} (dust) and other total suspended particulates (particles of sizes up to 50 micrometers) (Araújo et al. 2014). According to Araújo et al. (2014), construction site activities may influence the environment in the immediate area or neighborhood through emissions of total suspended particulate. Total suspended particulates are particles that have lower permanence in the atmosphere, thereby depositing near the emission sources (Araújo et al. 2014). The dispersion and concentration of particulate matter emissions depend on the technology and management control methods used by each project and the weather condition variables (i.e., wind speed,

wind direction, and humidity/moisture) (Araújo et al. 2014). Compliance with state permitting requirements and following BMPs can reduce off-site effects from fugitive dust.

Emissions of criteria air pollutants would also occur outside the planning area from transport, processing, distribution, and end-use. Generally, crude oil from the well fields in the San Juan Basin of northwestern New Mexico is transported to the crude oil refinery in Artesia, located in southeastern New Mexico. The refinery processes crude oil and serves markets in the southwestern United States and northern Mexico. A small refinery in northwestern New Mexico, which processed local San Juan Basin crude oil, closed in 2020 (EIA 2023b). Natural gas is produced from shales, low permeability sands, and coalbeds in the San Juan Basin in northwestern New Mexico. Interstate pipelines bring natural gas into New Mexico from Texas and Colorado and carry most of the natural gas that leaves the state to Arizona or back to Texas. Some of New Mexico's natural gas is placed in the state's two underground storage fields (EIA 2023b). Since combustion of all petroleum products emit criteria and HAP emissions, local ambient concentrations of these pollutants could increase in areas where products from the San Juan Basin (oil and gas) are combusted. This could contribute to an area exceeding either national or local air quality standards. Air quality involves complex physical and chemical transformations at local/regional levels, so impacts would vary considerably depending on background concentrations, meteorology, and other local pollutant sources. If any pollutant concentration is near or above its standard in a particular area, the combustion of oil and gas products could contribute to or exacerbate nonattainment. Potential pollutant concentration changes resulting from combustion are therefore often a key driver of public policy to mitigate air quality and public health impacts in such areas. Downstream combustion and end uses are regulated by the EPA or delegated to state agencies.

NO ACTION ALTERNATIVE

Under the No Action Alternative, the BLM would not offer any of the nominated parcels in this lease sale. However, in the absence of a Land Use Plan Amendment closing the lands to leasing, the parcels could be considered for inclusion in future lease sales. No new emissions associated with new federal oil and gas development for the subject lease would occur under the No Action Alternative in the foreseeable future.

MITIGATION MEASURES AND RESIDUAL EFFECTS CONSIDERED IN THE ANALYSIS

Based on the BLM's authority under the standard terms and conditions, the BLM requires industry to incorporate and implement BMPs, which are designed to reduce effects on air quality. Typical measures include requirements for watering dirt roads or applying magnesium chloride dust suppressants on dirt roads during periods of high use to reduce fugitive dust emissions of PM_{10}; colocation of wells and production facilities to reduce new surface disturbance; implementation of directional and horizontal drilling and completion technologies whereby one well provides access to petroleum resources that would normally require the drilling of several vertical wellbores; suggestions that vapor recovery systems be maintained and functional in areas where petroleum liquids are stored; green completions where technically feasible; and interim reclamation to revegetate areas not required for production facilities and reduce the amount of fugitive dust. Examples of additional air quality control measures imposed at the APD stage may include submission of an emissions inventory for the plan of development, air quality modeling, or implementation of mitigation measures and BMPs. The BLM would do this in coordination with the EPA, NMED, and other agencies that have jurisdiction on air quality. At the APD stage, COAs could be applied based on site-specific environmental analysis for the APD. Emission control techniques would be further evaluated when specific lease development projects are proposed.

The BLM also encourages industry to participate in the Natural Gas STAR program, administered by the EPA. The Natural Gas STAR program is a flexible, voluntary partnership that encourages oil and natural gas companies to adopt proven, cost-effective technologies and practices that improve operational efficiency and minimize impacts to air quality (EPA 2024c). Additionally, EPA and State of New Mexico rules and regulations help to reduce emissions.

The EPA has New Source Performance Standards (NSPSs) in place at 40 C.F.R. § 60, Subparts OOOO and OOOOa, to reduce VOCs from well completion operations and storage tanks, and impose emissions limits, equipment design standards, and monitoring requirements on oil and gas facilities. The new EPA *Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification or Reconstruction Commenced After November 15, 2021* (40 C.F.R. § 60, Subpart OOOOb) will sharply reduce emissions of CH_4 and other harmful air pollution from oil and natural gas operations. The final action includes NSPSs to reduce CH_4 and smog-forming VOCs from new, modified, and reconstructed sources.

At the state level, the New Mexico EMNRD published the NMOCD Statewide Natural Gas Capture Requirements (Waste Prevention Rule) (NMAC 19.15.27) on May 25, 2001, as part of the New Mexico statewide enforceable regulatory framework to secure reductions in oil and gas sector emissions and to prevent natural gas waste from new and existing sources. Key provisions include prohibition of unnecessary venting and flaring of waste natural gas where it is technically feasible to route the gas to pipeline or to use this gas for some other beneficial purpose (such as on-site fuel consumption). In all cases, operators must flare rather than vent natural gas except where this is technically infeasible or would pose a safety risk. These provisions will reduce VOC emissions due to stringent limitations on natural gas venting which results in un-combusted VOC emissions. Additionally, it proposes that natural gas be recovered and reused rather than flared, which would result in reductions of VOCs, NO_X, CO, SO_2, GHGs, and PM emissions. The NMED developed the Oil and Natural Gas Regulation for Ozone Precursors (NMAC 20.2.50) which was published on July 26, 2022, with an effective date of August 5, 2022. Approximately 50,000 wells and associated equipment will be subject to this regulation. It is anticipated that the regulation will annually reduce VOC emissions by 106,420 tons, NO_X emissions by 23,148 tons, and CH_4 emissions by 200,000 to 425,000 tons. The regulation includes emission reduction requirements for compressors, engines and turbines, liquids unloading, dehydrators, heaters, pneumatics, storage tanks, and pipeline inspection gauge launching and receiving. A description of federal and state rules and regulations can be found in Section 2 of the ARTR (BLM 2023a), incorporated by reference.

3.6.1.6 *Cumulative Effects*

Cumulative impacts for air quality are the result of the incremental impacts from the Proposed Action when added to other past, present, and reasonably foreseeable future actions. The sections below describe trends in air quality and how they relate to past and present oil and gas activities and projected emissions through modeling for the FFO RFD and RPFO RFD scenarios. The cumulative effects analysis area is the San Juan Basin and the surrounding airshed. More information regarding cumulative effects can be found in Chapters 3, 6, 8, and 9 of the ARTR (BLM 2023a), incorporated by reference.

EMISSIONS TRENDS

Past and present actions that have affected and would likely continue to affect air quality in the analysis area include surface disturbance resulting from ongoing oil and gas development and associated infrastructure, geophysical exploration, ranching, livestock grazing, range improvements, recreation (including off-highway vehicle use), authorization of rights-of-way 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 here but would include the development or conversion of power plants, the

development of energy sources such as oil and gas, the development of highways and railways, 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.

Emissions in the oil and gas sector roughly parallel oil and gas production. Future trends in oil and gas production growth for the Mountain Region (Montana, Idaho, Wyoming, Nevada, Utah, Colorado, Arizonia, and New Mexico) are used from the EIA 2023 Annual Energy Outlook (EIA 2023a) to provide an estimate of the change in emissions from oil and gas sources in New Mexico. U.S. production of natural gas and petroleum and liquids is projected to rise amid growing demand for exports and industrial uses. U.S. natural gas production is expected to increase by 15% from 2022 to 2050, while crude oil is expected to increase by 11% during the same period. Similarly, oil and gas–related CAP and HAP emissions from existing and foreseeable wells, plus development of lease parcels, are anticipated to rise due to increasing production.

Design value trends for pollutants in the San Juan Basin can be found in Section 3 of the ARTR (BLM 2023a), incorporated by reference. Ozone (8-hour) design value trends from the 2011-2013 design value to the 2021-2023 design value (EPA 2024b) indicate a slight increasing to a steady/flat trend, depending on the county in the San Juan Basin. Nationally, ozone (O_3) concentrations at urban and rural sites have decreased 29% from 1980 to 2022. Since the late 1990s, concentrations of O_3-depleting substances have been declining due to the successful implementation of the Montreal Protocol on Substances that Deplete the Ozone Layer (United Nations Environment Programme [UNEP] 1987). The long-term decrease is also likely driven by reductions in global emissions of substances that lead to the formation of O_3, such as O_3 precursors such as volatile organic compounds (VOCs) and nitrogen oxide(s) (NO_x). In correlation over the same period, emissions of VOCs and NO_x have decreased by 61% and 72%, respectively (BLM 2023a).

In Farmington, New Mexico, O_3 concentrations decreased 1.4% from 2011 to 2023 (BLM 2023a; EPA 2024b), although the data over this period has been variable with values ranging from 0.066 parts per million (ppm) to 0.071 ppm. Design values in the FFO for O_3 have shown a flat to slightly increasing curve from 2018 to 2023, more specifically San Juan County increased from 0.069 ppm to 0.070 ppm (1.4% increase over 5 years) (BLM 2023a; EPA 2024b). Future reductions are anticipated as per the Statewide Natural Gas Capture Requirements (New Mexico Administrative Code [NMAC] 19.15.27.9) and the New Mexico Environment Department (NMED) Ozone Attainment Initiative (20.2.50.1 NMAC).

Additionally, monitored CO concentrations have decreased nationally 88% from 1980 to 2022 due to improvements in motor vehicle emissions control and monitoring. CO concentrations in the southwest region of the United States have decreased 70% between 2000 and 2022. While outside the project area, the closest CO monitors are located in La Plata County, Colorado, and show the CO 8-hour emission design values at a declining to flat curve from 2016 to 2023 (EPA 2024b). Nationally, SO_2 concentrations have decreased 85% from 2000 to 2022, but substantial decreases (94% reduction) have occurred since 1980 due to implementation of federal rules requiring reduction in SO_2 emissions from power plants and other larger sources of SO_2. SO_2 concentrations in the southwest region of the United States have decreased 94% between 2000 and 2022 (BLM 2023a). Design values for SO_2 emissions in San Juan County have shown a decreasing curve from 2013 to 2016, then a flat to slightly decreasing curve from 2017 to 2023 (EPA 2024b).

Design values for nitrogen dioxide (NO_2) emissions in San Juan County have shown a relatively flat curve for the last 5 years. Design values for particulate matter equal to or less than 2.5 microns in diameter ($PM_{2.5}$) annual and 24-hour emissions at slightly declining to flat curves from 2013 to 2023 (EPA 2024b).

REASONABLY FORESEEABLE DEVELOPMENT

While there are other sources of emissions in the FFO, oil and gas development is one of the most prominent sources of emissions. There are approximately 21,873 active oil and gas wells in the New Mexico portion of the San Juan Basin. Of this total, roughly 15,631wells are federal, with the remainder falling in other jurisdictions (NMOCD 2024). Over the past 8 years, there have been a total of 332 federal well spuds, all of which occurred within the FFO and RPFO (Table 3.22).

Table 3.22. Past and Present Federal Well Spuds

Number of Federal Well Spuds	2016	2017	2018	2019	2020	2021	2022	2023
BLM FFO New Mexico portion of San Juan Basin	20	67	43	33	11	49	71	35
BLM RPFO New Mexico portion of San Juan Basin	0	0	0	0	0	1	2	0
Total*	**20**	**67**	**43**	**33**	**11**	**50**	**73**	**35**

Source: BLM Petroleum Engineering Group, FFO (BLM 2023e)

*The number of well completions within the FFO and RPFO.

As with past and present actions, continued oil and gas development is the most prominent reasonably foreseeable environmental trend and planned action affecting air quality in the analysis area. The FFO Mancos-Gallup RFD (2018 RFD) estimates that there could be an additional 3,200 (federal and non-federal) wells drilled within the analysis area by 2037, of which 2,490 would be federal (Crocker and Glover 2018). In addition, the RPFO RFD (2019 RFD) estimates that an additional 200 wells will be built within the analysis area by 2039, of which 129 would be federal (Crocker and Glover 2019). With consideration of both RFDs, there would be an estimated 3,400 wells drilled within the New Mexico portion of the San Juan Basin by 2039, with an average of 170 wells per year (of which 131 would be federal). The RFD scenarios attempt to predict the development scenario without factoring in economics and demand; therefore, the predicted numbers may not represent actual development. As noted above, there have been far fewer than 170 total (131 federal) wells spudded each year over the past 5 years. The FFO and RPFO RFD emissions/percentages shown in Table 3.23. are a conservative estimate based on actual wells spudded per year. Emissions per well come from the ARTR, which is incorporated by reference.

Table 3.23 Total and Federal FFO/RPFO Emissions/Percentage Per Year Based on the RFD

	Total Emissions (tons per year)						
	PM_{10}	$PM_{2.5}$	VOC	NO_x	CO	SO_x	Total HAPs
Total emissions from RFD (170 wells)	2,346.00	346.80	2,254.20	2,896.80	1,604.80	0.36	86.70
Federal emissions from RFD (131 wells)	1,807.80	267.24	1,737.06	2,232.24	1,236.64	0.28	66.81
Current emissions – 2020 NEI (San Juan, Sandoval, Rio Arriba, and McKinley Counties)	24,218	6,042	141,794	53,708	108,755	2,301	15,278
Total RFD percent of San Juan Basin emissions (170 wells)	**9.69%**	**5.74%**	**1.59%**	**5.39%**	**1.48%**	**0.02%**	**0.57%**
Federal RFD percent of San Juan Basin emissions (131 wells)	**7.46%**	**4.42%**	**1.23%**	**4.16%**	**1.14%**	**0.01%**	**0.44%**

Future potential development on the nominated lease parcels is estimated at sixteen wells (thirteen horizontal wells and three vertical wells) (see Table 3.1). The future potential development of the nominated lease parcels associated with the Proposed Action comprises 0.47% of the projected wells in the RFD scenario (3,400 wells) and would be 9.41% of the annual RFD (170 federal and non-federal wells). Reasonably foreseeable trends and planned actions would incrementally contribute to increases in criteria pollutants between 0.02% to 9.69% of existing annual emissions of all well development, federal and non-federal (see Table 3.23).

AIR QUALITY AND AIR QUALITY-RELATED VALUES MODELING

The Comprehensive Air Quality Model with Extensions (CAMx) photochemical grid model (PGM) is used in the Colorado Air Resources Management Modeling Study (CARMMS) 2.0 to assess the air quality (AQ) and Air Quality Related Value (AQRV) impacts associated with BLM-authorized mineral development on federal lands within the BLM Colorado planning areas and the BLM FFO planning areas. CARMMS 2.0 uses data from the modeling platform of Western Air Quality Study from the Intermountain West Data Warehouse for the 2011 base year and 2025 future-year air quality modeling and has adopted a two-way nested 12/4 kilometer horizontal resolution domain. Three 2025 future-year oil and gas levels were developed for a range of potential outcomes, a high development scenario, a low development scenario, and a medium development scenario (which is a mitigated version of the high development scenario where additional emissions controls were applied). Additional information on CARMMS 2.0 methodology can be found in the CARMMS 2.0 Report, incorporated by reference (BLM and Ramboll 2018).

The estimated emissions, AQ, and AQRV impacts from oil and gas development from Mancos Shale are modeled in the CARMMS 2.0 and are used to estimate impacts from development in the Air Impact Assessment for BLM Farmington Field Office Oil and Gas Development report (BLM and Ramboll 2018), incorporated by reference. In CARMMS 2.0, 74% of Mancos Shale gas well activity is assumed to occur in New Mexico, with remaining Mancos Shale gas well activity occurring in Colorado. All Mancos Shale oil well activity is estimated to occur in New Mexico. Most Mancos Shale activity in New Mexico occurs in the FFO; a small portion of the southeastern part of Mancos Shale activity is located outside of the FFO (in the RPFO). The Mancos Shale was treated as a separate source group in the CARMMS 2.0 modeling and AQ and AQRV impacts from the Mancos Shale separately quantified, enabling this analysis for the FFO/RPFO. As stated above, with consideration of both RFDs, there would be an estimated 3,400 (federal and non-federal) wells drilled within the New Mexico portion of the San Juan Basin by 2039. Between 2018-2025, the Mancos-Gallup RFD predicts 809 total wells, with 629 being federal wells. In contrast, in CARMMS 2.0 it is estimated that between 2016-2025 there will be 2,756 new oil and gas wells for the high scenario and 1,378 new oil and gas wells for the low scenario in the Mancos Shale in New Mexico. To complete a comparison between the RFD and CARMMS 2.0, the 2016- and 2017-year estimates from CARMMS 2.0 were added to the Mancos-Gallup RFD to analyze the same years (2016-2025). As a result, the new Mancos-Gallup RFD well number estimates between 2016-2025 are 1,009 new total oil and gas wells and 829 new federal oil and gas wells. Compared to the Mancos-Gallup RFD, CARMMS 2.0 predicts that 369 more total wells under the low scenario and 1,747 more total wells under the high scenario would be developed by 2025 than predicted by the RFD. Note, that if all the 200 wells from the RPFO RFD, the new well total through 2039, were added into the comparison of the CARMMS 2.0 modeling, it would still result in more wells developed by 2025 in the CARMMS 2.0 modeling than predicted by the RFD. While the wells associated with these leases are included as part of the RFD, even if they were not, the CARMMS 2.0 modeling would still result in more wells developed by 2025 than predicted by the RFD. As a result, the low and high scenarios of CARMMS 2.0 well development estimates are conservatively high relative to the RFD baseline scenario and current development (BLM and Ramboll 2018, Section 2.1.1.1). Therefore, the low scenario can be used to represent a conservative estimate of federal and planning area-wide impacts through 2025.

The O_3 NAAQS are defined as the 3-year average of the fourth highest daily maximum 8-hour (DMAX8) O_3 concentration. Since CARMMS 2.0 only uses one year of meteorology (2011), the 2025 fourth highest DMAX8 O_3 concentration is used as a pseudo-NAAQS comparison metric. For the 2011 Base Case, there are vast regions where the modeled fourth high DMAX8 O_3 exceeds the NAAQS (all source groups). In the 2025 high, low, and medium development scenarios, the areas of O_3 exceedances decrease from the 2011 Base Case, with the 2025–2011 O_3 differences showing decreases in almost all areas. The large contribution of natural emissions (natural wildfires) to the modeled fourth highest DMAX8 O_3 concentrations was noted in the analysis. Maximum O_3 contributions to the 2025 fourth highest DMAX8 O_3 due to the New Mexico FFO are 1.7 parts per billion (ppb), 0.9 ppb and 1.0 ppb for the 2025 high, low, and medium development scenarios, respectively. Maximum contributions of the New Mexico FFO O_3 to the fourth highest DMAX8 O_3 above the current O_3 NAAQS (71.0 ppb and higher) for the 2025 high, low, and medium development were 2.01%, 0.84%, and 0.90%, respectively (BLM and Ramboll 2017).

There are two $PM_{2.5}$ NAAQS, one for a 24-hour averaging time that is expressed as a 3-year average of the 98th percentile value in a year with a threshold of 35 microgram per cubic meter ($\mu g/m^3$) and an annual average over 3 years with a threshold of 12 $\mu g/m^3$ (although the standard is now 9 $\mu g/m^3$). With a complete year of modeling results, the 98th percentile corresponds to the eighth highest daily $PM_{2.5}$ concentration in a year. The modeling of the differences between the 2025 scenarios and 2011 Base Case (all sources) show decreases of $PM_{2.5}$ concentrations in most of the domain, but also increases in a number of regions, including Denver, eastern Utah, and central and northwestern New Mexico. Maximum $PM_{2.5}$ contributions to the eighth highest daily $PM_{2.5}$ concentrations are 0.8, 0.4 and 0.4 $\mu g/m^3$ in the 2025 high, low, and medium development scenarios, respectively. Compared to 2011, 2025 annual $PM_{2.5}$ concentrations for all sources are reduced in most of the domain, but increase in a number of regions, including near Denver. Maximum contributions to the annual average $PM_{2.5}$ concentrations for the New Mexico FFO are 0.3, 0.1, and 0.1 $\mu g/m^3$ in the 2025 high, low, and medium development scenarios, respectively. Maximum contributions to the second highest daily average PM_{10} for the New Mexico FFO are 2.7, 1.3, and 1.1 $\mu g/m^3$ in the 2025 high, low, and medium development scenarios, respectively (BLM and Ramboll 2017).

The differences in 1-hour NO_2 concentrations between the 2011 and 2025 emission scenarios (all sources) indicate increases at various regions throughout the domain, including large increases in northern and eastern Arizona and New Mexico. Maximum contributions to the 1-hour NO_2 concentrations for the New Mexico FFO are 5.8, 3.0, and 3.2 $\mu g/m^3$ in the 2025 high, low, and medium development scenarios, respectively. Maximum contributions to the annual average NO_2 concentrations for the New Mexico FFO are 1.5, 0.8, and 0.9 $\mu g/m^3$ in the 2025 high, low, and medium development scenarios, respectively (BLM and Ramboll 2017).

Contributions of the prevention of significant deterioration (PSD) pollutant concentrations across all PSD Class I and other Class II areas due to emissions from the FFO for each development scenario were also developed. Contributions of New Mexico FFO emissions to PSD pollutant concentrations at Class I and other Class II areas for the 2025 high, low, and medium development scenarios can be found in the Air Impact Assessment for BLM Farmington Field Office Oil and Gas Development report (BLM and Ramboll 2017) and has been incorporated by reference. All New Mexico FFO contributions are below the PSD Class I and Class II pollutant increments at the high, low, and medium development scenarios.

Annual sulfur deposition levels at Class I and other Class II areas within 100 km of the planning area (2025 total emissions), when compared against a critical load value of 5 kg/ha-yr) showed all locations below the deposition analysis thresholds for all three scenarios. Annual nitrogen deposition levels at Class I and other Class II areas within 100 km of the planning area (2025 total emissions), when compared against a critical load value of 2.3 kg/ha-yr) showed some locations in excess of the deposition analysis

thresholds at all three scenarios. However, federal oil and gas activities do not appear to be the main driver of regional nitrogen deposition impacts as there is little change across the high, medium, and low scenarios. All Class I and Class II areas experienced a reduction in annual nitrogen deposition between 2011 and 2025 (BLM and Ramboll 2017).

In summary, the CARMMS 2.0 low scenario, which represents a conservative estimate of federal impacts through 2025, does not exceed the indicator thresholds for any of the NAAQS, PSD Class I or Class II increment thresholds, the sulfur deposition threshold, the change in visibility threshold at any Class I area, or the thresholds for acid neutralizing capacity at sensitive lakes. The low scenario would exceed the indicator threshold for change in visibility at one Class II area, the Aztec Ruins National Monument, and the nitrogen deposition threshold at Mesa Verde National Park, San Pedro Parks Wilderness, Weminuche Wilderness, Aztec Ruins National Monument, Chama River Canyon Wilderness, South San Juan Wilderness, and Cruces Basin Wilderness. The CARMMS 2.0 high scenario would not exceed any of the PSD Class I or Class II increment thresholds, the change in visibility threshold at Class I areas, the sulfur deposition threshold, or the thresholds for acid neutralizing capacity at sensitive lakes. It would exceed the NAAQS indicator thresholds for O_3, annual average $PM_{2.5}$, and annual average NO_2; the change in visibility threshold at one Class II area, Aztec Ruins National Monument; and the nitrogen deposition threshold at Bandelier Wilderness, Mesa Verde National Park, San Pedro Parks Wilderness, Weminuche Wilderness, Aztec Ruins National Monument, Chama River Canyon Wilderness, Cruces Basin Wilderness, Dome Wilderness, Monte Vista National Wildlife Refuge, South San Juan Wilderness, and Sandia Mountain Wilderness.

New Mexico Ozone Attainment Initiative Study

The State of New Mexico initiated the New Mexico Ozone Attainment Initiative (OAI) Photochemical Modeling Study (New Mexico OAI Study) in the spring of 2018 to address the high O_3 concentrations in the state, protect the O_3 attainment status of the state, and ensure health and welfare of the residents of the state for future generations (NMED 2021). Based on the WRAP, Western Air Quality Study (WAQS) CAMx 2014 36/12-km modeling platform, a CAMx 2014 36/12/4-km O_3 modeling platform was developed with the 4-km domain focused on New Mexico and adjacent states. Additional methodology can be found in Section 6 of the ARTR (BLM 2023a). The New Mexico OAI Study also looked at 2028 future year base case modeling and oil and gas control sources. The 2028 oil and gas control strategy reduced oil and gas NO_x emissions by approximately 21,000 tpy (or by 64% compared to the 2028 base case) and oil and gas VOC emissions by approximately 53,000 tpy (or by 46% compared to the 2028 base case) (BLM 2023a).

For the San Juan Basin, the 2028 base case saw future O_3 design value reductions of −5.6 ppb at Bernalillo in Sandoval County, and −2.2 ppb and −3.3 ppb at Bloomfield and Navajo Lake, respectively, in San Juan County. The 2028 oil and gas control strategy saw future O_3 design value reductions of −1.5 ppb and −0.8 ppb at Navajo Lake and Bloomfield, respectively, and −0.3 ppb at Bernalillo from the 2028 base case. Using this method and following EPA guidance, all 2028 projected O_3 future design values at monitoring sites in New Mexico were below the 2015 NAAQS for O_3 of 70 ppb using the 2012–2016 design value, including those in the San Juan Basin (base and control) (BLM 2023a).

The New Mexico OAI study also looked at more recent design values (2015-2019 and 2017-2019). The results of the sensitivity study using the 2015-2019 O_3 design values for the San Juan Basin showed all 2028 projected O_3 future design values at monitoring sites were below the 2015 NAAQS for O_3 of 70 ppb (base and control). The results of the sensitivity study using the 2017-2019 O_3 design values for the San Juan Basin showed all 2028 projected O_3 future design values at monitoring sites were below the 2015 NAAQS for O_3 of 70 ppb (base and control) (BLM 2023a).

The final part of the New Mexico OAI Study investigated source apportionment and was conducted to determine the contributions of source sectors to 2028 future year O_3 design values under the oil and gas control strategy scenario. One investigation involved international emissions. The speciated modeled attainment test (SMAT) O_3 projection tool was run without the contributions of international anthropogenic emissions for current design values 2012-2016, 2015-2019, and 2017-2019. In New Mexico, international anthropogenic emissions contributed from 11 to 26 ppb to the projected 2028 future design values. The Bloomfield site, in the northern part of the state and in San Juan County, had reductions of 13.8 ppb, 14.5 ppb, and 14.6 ppb, respectively. Bloomfield, which had not produced a projected 2028 O_3 exceedance for either the 2008 and 2015 NAAQS for O_3 under the current design value 2017-2019 scenario (68 ppb), was below 50 ppb for a future design value under all three design value scenarios (2012-2016, 2015-2019, and 2017-2019) (BLM 2023a). Additional information on the New Mexico OAI study can be found in Section 6 of the Air Technical Report (BLM 2023a), incorporated by reference.

BLM 2032 Regional Criteria Air Pollutants Modeling Study

The BLM developed a 12km grid spacing, Comprehensive Air quality Model with extensions (CAMx) photochemical modeling platform to assess the impacts of oil and gas development and coal production and other cumulative sources on air quality in the western United States (Utah, Colorado, New Mexico, Wyoming, Montana, North Dakota, and South Dakota). The modeling analysis evaluated air quality and air quality–related values out to a future year of 2032 using data from the Western Regional Air Partnership (WRAP)/Western Air Quality Study (WAQS) modeling platform, the EPA's 2016v2 emissions modeling platform (EPA 2022c), and the BLM oil and gas development projections to quantify and apportion federal and non-federal oil and gas emissions (BLM and Ramboll 2023b).

The BLM regional criteria air pollutant modeling study results show that the cumulative concentrations over New Mexico range between 50 and 65 ppb in New Mexico, with the higher concentrations in the San Juan Basin and isolated regions on the western side of the state. The modeled values did not lead to any O_3 NAAQS exceedances in the state, including in the Farmington area. Farmington area ozone cumulative concentrations ranged from 55 to 65 ppb (highest value of 64.4 ppb). The largest contributions to O_3 are due to the modeled boundary conditions, followed by other anthropogenic sources (i.e., those not including oil, gas, or coal source groups) and natural sources.

1-hour NO_2 modeled cumulative concentrations showed the highest concentrations over the San Juan Basin (highest value of 60.0 ppb). The modeled values did not lead to any 1-hour NO_2 NAAQS exceedances in the state. Farmington area 1-hour NO_2 cumulative concentrations ranged from 0.5 to 60 ppb. The largest contributions to 1-hour NO_2 are due to federal, non-federal, and tribal oil and gas development.

24-hour $PM_{2.5}$ modeling showed a northwest to southeast gradient, with larger $PM_{2.5}$ concentrations on the southeastern side of New Mexico. The largest 24-hour $PM_{2.5}$ concentration in the state is 47.2 $\mu g/m^3$ in Socorro County (primarily due to wildfires). As a result, the modeled values did exceed the 24-hour $PM_{2.5}$ NAAQS in Socorro County, New Mexico, but nowhere else in the state was the NAAQS exceeded. Farmington area 24-hour $PM_{2.5}$ cumulative concentrations ranged from 2 to 10 $\mu g/m^3$. The largest contributors to 24-hour $PM_{2.5}$ are wildfires and non-coal, oil, or gas anthropogenic sources. Annual $PM_{2.5}$ modeled values showed cumulative concentrations over New Mexico did not lead to any annual $PM_{2.5}$ NAAQS exceedances. Cumulative annual $PM_{2.5}$ concentrations were highest near Albuquerque, which were due to other anthropogenic sources (i.e., those not including oil, gas, or coal source groups) and generally less than 4 $\mu g/m^3$ within the rest of New Mexico. Farmington area annual $PM_{2.5}$ cumulative concentrations ranged from >0 to 6 $\mu g/m^3$. The largest contributors to annual $PM_{2.5}$ are the anthropogenic and wildfire sources.

24-hour PM_{10} cumulative concentrations showed PM_{10} NAAQS exceedances in a few grid cells in southwestern New Mexico (primarily due to wildfires). PM_{10} cumulative concentrations over most of New Mexico ranged between 2 and 30 mg/m^3, with smaller areas of concentrations between 30 and 150 mg/m^3. Farmington area 24-hour PM_{10} cumulative concentrations ranged from 2 to 30 $\mu g/m^3$. The largest contributors to annual PM_{10} are wildfires and other anthropogenic sources (i.e., those not including oil, gas, or coal source groups).

1-hour SO_2 modeled cumulative concentrations over New Mexico did not lead to any 1-hour SO_2 NAAQS exceedances. Most of the state had concentrations that did not exceed 10 ppb, except for a few southeastern counties (e.g., Eddy, Lea and Roosevelt) where concentrations ranged from 5 to 69 ppb. Farmington area 1-hour SO_2 cumulative concentrations ranged from >0 to 5 ppb. The largest contributors to 1-hour SO_2 in New Mexico are oil and gas activities and wildfires. 3-hour SO_2 modeled cumulative concentrations showed no exceedances of the 3-hour SO_2 NAAQS. Farmington area 3-hour SO_2 cumulative concentrations ranged from >0 to 5 ppb. The largest contributors to 3-hour SO_2 in New Mexico were oil and gas activities, other anthropogenic sources (i.e., those not including oil, gas, or coal source groups), and wildfires.

1-hour CO modeled cumulative concentrations over New Mexico did not lead to any 1-hour CO NAAQS exceedances. Most of the state had concentrations less than 5 ppm, although Socorro County had concentrations to up 10 ppm. Farmington area 1-hour CO cumulative concentrations ranged from 0.1 to 3 ppm. 8-hour CO modeled cumulative concentrations over New Mexico did not lead to any 8-hour CO NAAQS exceedances. Most of the state had concentrations less than 5 ppm, although Socorro County had concentrations to up 6.9 ppm. Farmington area 8-hour CO cumulative concentrations ranged from 0.1 to 0.8 ppm. The location of the higher 1-hour and 8-hour CO concentrations is the same location as the PM_{10} peak, indicating that natural sources (likely fires) are responsible for the higher 1-hour and 8-hour CO in this area (BLM and Ramboll 2023b).

Cumulative annual nitrogen deposition over most of New Mexico varies between around 1 and 6 kilograms of nitrogen per hectare (kg N/ha-year) with an east-to-west gradient. The eastern part of the state shows nitrogen deposition generally between 2 and 6 kg N/ha-year, whereas the west side of the state is generally lower, with nitrogen deposition ranging from 1 to 4 kg N/ha-year (although higher deposition is present in a few grid cells in San Juan County). Nitrogen critical loads for the Class I areas in the New Mexico analysis area range from 3.0 to 7.54 kg N/ha. The cumulative average nitrogen deposition ranges from 1.2 at Petrified Forest National Park to 2.7 kg N/ha-year at Carlsbad Caverns National Park. None of the areas exceed the critical load thresholds for cumulative average nitrogen deposition. The largest contributors to the cumulative average nitrogen deposition are other anthropogenic sources (i.e., those not including oil, gas, or coal source groups), ranging from 40% to 60% depending on the area of interest. The cumulative maximum nitrogen deposition values in all Class I areas of interest are below their critical loads for atmospheric nitrogen deposition, except for Carlsbad Caverns National Park.

Cumulative annual sulfur deposition over most of New Mexico ranges between 0.1 and 2.0 kilograms of sulfur per hectare (kg S/ha-year), with higher concentrations in the southeastern part of the state. In the southeastern part of the state, concentrations generally range between 1 and 4 kg S/ha-year (although a few grid cells show concentrations between 4 and 9 kg S/ha-year in Roosevelt, Eddy, and Lea Counties.) For total sulfur deposition, the 5 kg/ha-year threshold published by Fox et al. (1989) is used as critical load for each area of interest. The cumulative average sulfur deposition ranges from 0.1 at Petrified Forest National Park/Great Sand Dunes National Park to 1.8 kg S/ha-year at Carlsbad Caverns National Park. None of the areas exceed for the critical load thresholds for cumulative average and maximum sulfur deposition. The largest contributors to sulfur deposition in New Mexico are oil and gas non-federal and existing federal sources and other anthropogenic sources (BLM and Ramboll 2023b). Additional

modeling results can be found in the BLM Regional Criteria Air Pollutant Photochemical Modeling Study (BLM and Ramboll 2023b), incorporated by reference.

In summary, atmospheric concentrations for criteria air pollutants in the project area are projected to be below the NAAQS based on future year (ca. 2032) modeling.

Cumulative Impacts Summary

In summary, the cumulative air quality in the impact analysis area is maintained at current levels or projected to improve. Atmospheric concentrations for CAPs are projected to be below the NAAQS. Visibility is generally projected to be steady or improving at national parks near the project area (BLM 2023a). Results for the nearest Class I areas to the analysis area show improving visibility trends for both the base (2014-2017) and future year (2028) deciview values on the 20% clearest and most impaired days. Nitrogen deposition conditions in NPS-managed areas near the project area are generally fair to good with no trend for improving or worsening conditions, while sulfur deposition conditions are fair to good and generally improving (where trend data are available). The cumulative average nitrogen deposition ranges from 1.2 at Petrified Forest National Park to 2.7 kg N/ha at Carlsbad Caverns National Park in future year (circa 2032) modeling. None of areas exceed the critical loads for cumulative average nitrogen deposition. The cumulative maximum nitrogen deposition values in all areas of interest are below their critical loads for atmospheric nitrogen deposition, except for Carlsbad Caverns National Park. The cumulative average sulfur deposition ranges from 0.1 at Petrified Forest National Park/Great Sand Dunes National Park to 1.8 kg S/ha-year at Carlsbad Caverns National Park in future year (circa 2032) modeling. None of the areas exceed for the critical load thresholds for cumulative average and maximum sulfur deposition.

Using the best science and data available (EPA's AirToxScreen), the current San Juan, Sandoval, Rio Arriba, and McKinley Counties cancer risk is 17.6, 18.7, 12.3, 11.1 per 1 million, respectively, and is within the contextual range published by the EPA. Additionally, the oil and gas activity in the San Juan Basin contribute a max of 12% to the total cancer risk in San Juan County (the county percentages for Sandoval, Rio Arriba, and McKinley are lower). The BLM's Western United States HAP photochemical modeling study showed adjusted cancer risk from cumulative oil and gas production for 2032 ranged from 0.03 to 6.15 per million in the San Juan Basin, which is well within the contextual range published by the EPA. While new production from the foreseeable development of the Proposed Action and from approved and pending APDs could outweigh the production decline from currently producing wells (EIA 2023a) and result in slightly higher HAPs emissions, an increase in oil and gas related HAPs emissions should not make a substantial change to cumulative HAPs impacts since the cancer risk is well within the contextual range published by the EPA and oil and gas contributes a small percentage to the cancer risk.

3.6.2 Issue 2: Greenhouse Gases and Climate Change

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

Future development of the of lease parcels under consideration could lead to emissions of carbon dioxide (CO_2), CH_4, and nitrous oxide (N_2O); the three most common GHGs 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 leasing 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 Annual GHG Report (BLM 2023c). This report presents the estimated emissions of GHGs 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?year=2022.

3.6.2.1 *Affected Environment*

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 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, general projections regarding potential impacts on natural resources and plant and animal species 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 to provide context of their potential contribution to climate change. Table 3.24 shows the total estimated GHG emissions from fossil fuels at the global, national, and state scales over the last 6 years. Emissions are shown in megatonnes (Mt) per year of carbon dioxide equivalent (CO_2e). Chapter 3 of the Annual GHG Report contains additional information on GHGs and an explanation of CO_2e. State and national energy-related CO_2 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.

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 (BLM 2023c: Chapters 5, 6, and 7).

Table 3.24. Global and U.S. Fossil Fuel Greenhouse Gas Emissions, 2016–2021

Scale	Emissions (Mt CO_2e/year)					
	2016	2017	2018	2019	2020	2021
Global (CO_2 only)	36,465.6	36,935.6	37,716.2	37,911.4	35,962.9	37,500.0
United States	4,909.9	4,852.5	4,989.8	4,855.9	4,344.9	4,639.1
New Mexico	48.8	49.4	45.2	48.4	45.0	46.0

Source: Annual GHG Report (BLM 2023c), Chap. 5, Table 5-1 (U.S.) and Table 5-2 (State). Global emissions (CO_2 only) from the Emissions Database for Global Atmospheric Research (EDGAR) 2023 Report - https://edgar.jrc.ec.europa.eu/report_2023?vis=co2tot#emissions_table (EDGAR 2023). State 2021 data: Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021 (EPA 2023c).

Mt (megatonne) = 1 million metric tons

NA = Not Available

3.6.2.2 *Environmental Consequences*

PROPOSED ACTION

While the leasing action does not directly result in development that would generate GHG emissions, emissions from future potential development of the leased parcels can be estimated for the purposes of this analysis. Four general phases of post-lease development processes would generate GHG emissions: 1) well development (well site construction, well drilling, and well completion), 2) well production operations (extraction, separation, gathering), 3) midstream (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 (phases 1 and 2) occur on-lease and the BLM has authority over these activities, midstream and end-use emissions (phases 3 and 4) typically occur off-lease where the BLM may have 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. Due to these uncertainties, the BLM applies several assumptions to estimate emissions at the leasing stage. The number of estimated wells per parcel is 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 would 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 CH_4 (a more potent GHG than CO_2 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 midstream emissions associated with lease parcels for this analysis would be similar to the national level emissions identified by the Department of Energy's National Energy Technology Laboratory (NETL) (NETL 2009, 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 in the BLM Lease Sale Emissions Tool (BLM 2024a) and lease development analysis. Emissions are presented for each of the four phases of post-lease development processes described above.

The emission estimates calculated for this analysis were generated using the assumptions[24] previously described above using the BLM Lease Sale Emissions Tool. Emissions are presented for each of the four phases of post-lease development described above.

- 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 20 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 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 (BLM 2023c: Chapter 6, Tables 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 C.F.R. § 98). Additional information on emission factors and EUR factors can be found in Chapter 6 of the Annual GHG Report (BLM 2023c).

Table 3.25 Estimated Direct and Indirect Emissions from Lease Parcels on an Annual and Life of Lease Basis (tonnes)

Timeframe	CO_2	CH_4	N_2O	CO_2e (100-year)	CO_2e (20-year)
Fourteen Wells (March 2019 Oil and Gas Lease Sale)					
Max Year	228,497	303.07	1.500	237,938	253,910
Average Year	80,330	129.34	0.504	84,321	91,137
Life of Lease	2,329,556	3,750.80	14.614	2,445,319	2,642,986
Two Wells (June 2019 Oil and Gas Lease Sale)					
Max Year	65,074	77.84	0.437	67,513	71,615
Average Year	14,469	23.30	0.091	15,188	16,416
Life of Lease	332,794	535.83	2.088	349,331	377,569

[24] Although some of the wells on the nominated lease parcels are projected to be vertical wells, this greenhouse gases analysis uses horizonal well emissions estimates, throughout. Therefore, this analysis is likely conservative.

16 Wells – Total Scenarios Combined					
Max Year	267,953	341.04	1.774	278,600	296,573
Average Year	91,805	147.81	0.576	96,367	104,157
Life of Lease	2,662,349	4,286.63	16.702	2,794,650	3,020,556

Source: BLM Lease Sale Emissions Tool (BLM 2024a)

Table 3.26 lists the estimated direct (well development and production operations) and indirect (mid-stream and end-use) GHG emissions in metric tonnes for the subject leases over the average 20-year[25] production life of the lease. In summary, potential GHG emissions from the Proposed Action could result in GHG emissions of 2,445,319 (fourteen wells), 349,331 (two wells), and 2,794,650 (sixteen wells) tonnes of CO_2e (100-yr) over the life of the lease.

Table 3.26. Estimated Life-of-Lease Emissions from Well Development, Well Production Operations, Mid-Stream, and End-Use

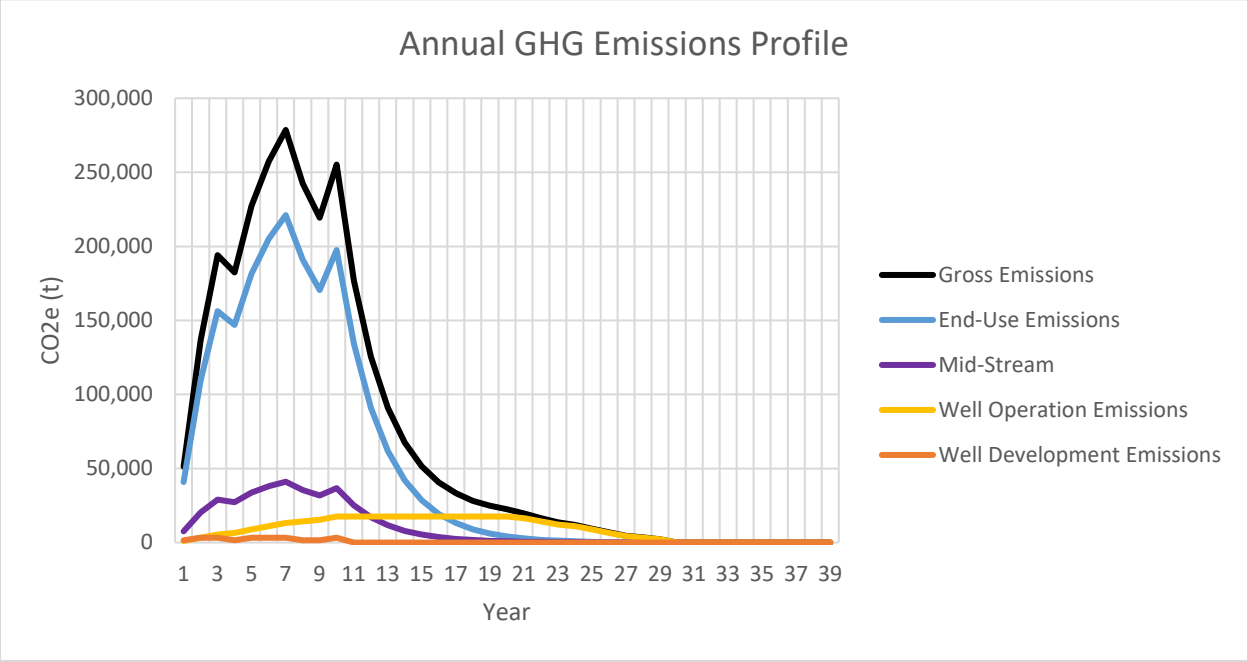
Activity	CO_2	CH_4	N_2O	CO_2e (100-yr)	CO_2e (20-yr)
		Fourteen Wells			
Well Development	22,505	9.24	0.182	22,830	23,317
Well Production Operations	262,447	1,512.00	0.560	307,657	387,340
Mid-Stream	265,951	2,173.68	4.079	331,840	446,393
End-Use	1,778,653	55.88	9.793	1,782,992	1,785,937
Total (life of lease)	2,329,556	3,750.80	14.614	2,445,319	2,642,986
		Two Wells			
Well Development	3,215	1.32	0.026	3,261	3,331
Well Production Operations	37,492	216.00	0.080	43,951	55,334
Mid-Stream	37,993	310.53	0.583	47,406	63,770
End-Use	254,093	7.98	1.399	254,713	255,134
Total (life of lease)	332,794	535.83	2.088	349,331	377,569
		Sixteen Wells – Total Scenarios Combined			
Well Development	25,720	10.56	0.208	26,091	26,648
Well Production Operations	299,939	1,728.00	0.640	351,608	442,674
Mid-Stream	303,944	2,484.20	4.661	379,246	510,163
End-Use	2,032,746	63.87	11.193	2,037,705	2,041,070
Total (life of lease)	2,662,349	4,286.63	16.702	2,794,650	3,020,556

Source: BLM Lease Sale Emissions Tool (BLM 2024a)

[25] For comparison, a well in New Mexico that produces for 30 years instead of 20 will result in total life-cycle emissions that are approximately 6.44% more of CO_2e (100-year GWP) and 7.48% more of CO_2e (20-year GWP).

Note: CO_2e calculated using IPCC Sixth Assessment Report Global Warming Potential (GWP) - 100-year GWP multiplier are as follows: CO_2=1, CH_4=29.8, N_2O=273; 20-year GWP: CO_2=1, CH_4=82.5, N_2O=273 (IPCC 2021).

GHG emissions vary annually over the production life of a well due to declining production rates over time. Figure 3.1 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. Assuming a 20-year well life, the lifetime production (EUR) is estimated to be 172,749 bbl of oil and 962,778 mcf of natural gas for one lease or 2,763,984 bbl of oil and 15,404,448 mcf of natural gas for all leases (sixteen wells).



Source: BLM Lease Sale Emissions Tool

Figure 3.1. Estimated greenhouse gas emissions profile over the life of the lease scenarios (16 wells total)

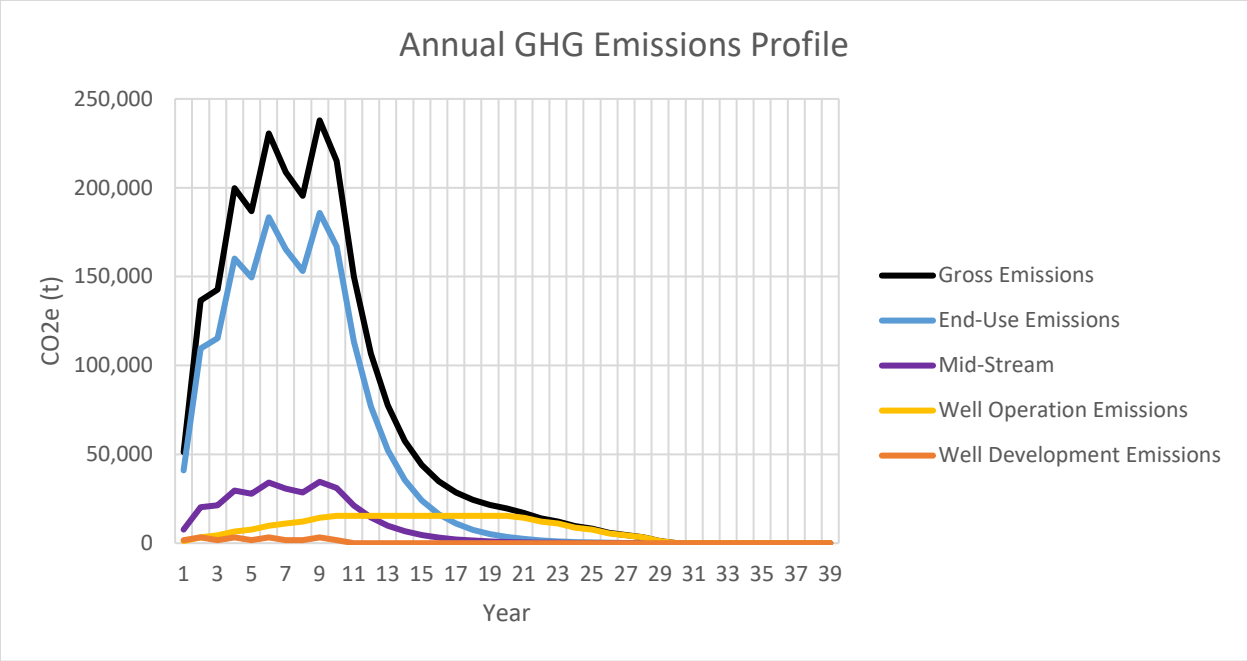


Figure 3.2. Estimated greenhouse gas emissions profile over the life of the lease scenarios (March 2019 - 14 wells total)

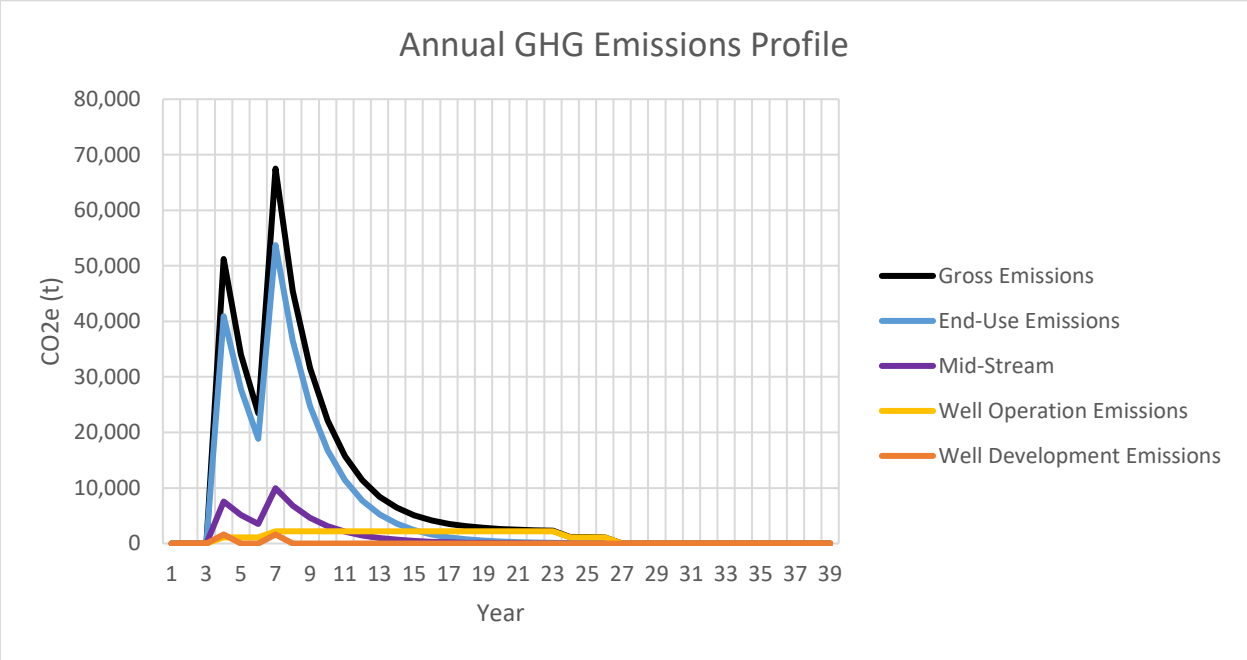


Figure 3.3. Estimated greenhouse gas emissions profile over the life of the lease scenarios (June 2019 - 2 wells total)

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. The EPA GHG equivalency calculator can be used to express the

potential average year GHG emissions on a scale relatable to everyday life (EPA 2023d). For instance, the projected average annual GHG emissions from potential development of the subject leases (March and June 2019 Lease Sales combine) are equivalent to 20,769 gasoline-fueled passenger vehicles driven for 1 year, or the emissions that could be avoided by operating 26 wind turbines as an alternative energy source or offset by the carbon sequestration of 114,723 acres of forest land for one year. Comparisons with the March/June lease sale can be found in Table 3.27.

Table 3.27. Comparison of the GHG Equivalency for each Lease Sale and Total Combined Lease Sale

Scenario	Equivalent to this Number of Gasoline-Fueled Passenger Vehicles Driven for 1 Year	Emissions Avoided by Operating this Number of Wind Turbines as an Alternative Energy Source	Emissions offset by the Carbon Sequestration of this Number of acres of forest land for 1 year
Fourteen Wells (March 2019 Lease Sale)	18,173	23	100,383
Two Wells (June 2019 Lease Sale)	3,273	4	18,081
Sixteen Total Wells (both Lease Sale combined)	20,769	26	114,723

Table 3.28 compares emission estimates over the 20-year life of the lease compared to the 30-year projected federal fossil fuel emissions in the state and nation from existing wells, the development of approved APDs, and emissions related to reasonably foreseeable lease actions.

Table 3.28. Comparison of the Life-of-Lease Emissions to Other Federal Oil and Gas Emissions

Reference	Mt CO_2e (100-year)	Life of Well Percentage of Reference
Fourteen Wells		
Proposed Action Emissions (life of lease)	2.445	100.000%
New Mexico reasonably foreseeable short-term federal (oil and gas)*	3,183.17	0.077%
New Mexico EIA-projected long-term federal (oil and gas)†	9,961.81	0.024%
United States reasonably foreseeable short-term federal (oil and gas)	6,033.00	0.040%
United States EIA projected long-term federal (oil and gas)	16,523.00	0.015%
Two Wells		
Proposed Action Emissions (life of lease)	0.379	100.000%
New Mexico reasonably foreseeable short-term federal (oil and gas)*	3,183.17	0.012%
New Mexico EIA-projected long-term federal (oil and gas)†	9,961.81	0.004%
United States reasonably foreseeable short-term federal (oil and gas)	6,033.00	0.006%
United States EIA projected long-term federal (oil and gas)	16,523.00	0.002%
Sixteen Wells – Total Scenarios Combined (March and June 2019 Lease Sales)		
Proposed Action Emissions (life of lease)	2.795	100.000%
New Mexico reasonably foreseeable short-term federal (oil and gas)*	3,183.17	0.088%

New Mexico EIA-projected long-term federal (oil and gas)†	9,961.81	0.028%
United States reasonably foreseeable short-term federal (oil and gas)	6,033.00	0.046%
United States EIA projected long-term federal (oil and gas)	16,523.00	0.017%

Source: U.S. and federal emissions from BLM Lease Sale Emissions Tool (BLM 2024a) data and Tables 7-18, 7-19 and Section 7 of the 2022 Annual GHG Report (BLM 2023c).

* Short-term foreseeable is estimated federal emissions from existing producing wells, approved APDs, and 1 year of leasing.

† Long-term foreseeable are estimated federal emissions to meet EIA-projected energy demand.

Compared to emissions from other existing and foreseeable federal oil and gas development, the life of lease emissions for the March 2019 Sale (fourteen wells) are between 0.077% and 0.024% of federal fossil fuel authorization emissions in the state and between 0.040% and 0.015% of federal fossil fuel authorization emissions in the nation. In summary, potential GHG emissions from the well scenarios combined (fourteen wells) could result in GHG emissions of 2.44 Mt CO_2e over the life of the well.

Compared to emissions from other existing and foreseeable federal oil and gas development, the life of lease emissions for the June 2019 Sale (two wells) are between 0.012% and 0.004% of federal fossil fuel authorization emissions in the state and between 0.006% and 0.002% of federal fossil fuel authorization emissions in the nation. In summary, potential GHG emissions from the well scenarios combined (two wells) could result in GHG emissions of 0.379 Mt CO_2e over the life of the well.

Compared to emissions from other existing and foreseeable federal oil and gas development, the life of lease emissions for the scenarios combined (sixteen wells) are between 0.088% and 0.028% of federal fossil fuel authorization emissions in the state and between 0.046% and 0.017% of federal fossil fuel authorization emissions in the nation. In summary, potential GHG emissions from the well scenarios combined (sixteen wells) could result in GHG emissions of 2.79 Mt CO_2e over the life of the well.

Table 3.29 compares the estimated annual proposed scenarios and total combine lease emissions to existing federal fossil fuel (oil, gas, and coal) emissions, state, and U.S. total GHG emissions.

Table 3.29. Comparison of Lease Sale Emissions to Other Sources (Megatonnes)

Reference	Mt CO_2e (100-year)	Life of Well Percentage of Reference
Fourteen Wells		
Proposed Action emissions (maximum year)	0.238	-
New Mexico onshore federal (oil and gas) †	326.00	0.07%
New Mexico onshore federal (oil, gas, and coal) †	331.85	0.07%
U.S. onshore federal (oil and gas) †	542.06	0.04%
U.S. federal-all (oil and gas) †‡	933.87	0.025%
U.S. federal onshore (oil, gas, and coal) †	1,033.21	0.023%
U.S. total (oil, gas, and coal) †	6,899.49	**0.003%**
Two Wells		
Proposed Action emissions (maximum year)	0.068	-
New Mexico onshore federal (oil and gas) †	326.00	0.021%

New Mexico onshore federal (oil, gas, and coal) †	331.85	0.020%
U.S. onshore federal (oil and gas) †	542.06	0.012%
U.S. federal-all (oil and gas) †‡	933.87	0.007%
U.S. federal onshore (oil, gas, and coal) †	1,033.21	0.007%
U.S. total (oil, gas, and coal) †	6,899.49	**0.001%**
Sixteen Wells – Total Scenarios Combined		
Proposed Action emissions (maximum year)	0.279	-
New Mexico onshore federal (oil and gas) †	326.0	0.085%
New Mexico onshore federal (oil, gas, and coal) †	331.85	0.084%
U.S. onshore federal (oil and gas) †	542.06	0.051%
U.S. federal-all (oil and gas) †‡	933.87	0.030%
U.S. federal onshore (oil, gas, and coal) †	1,033.21	0.027%
U.S. total (oil, gas, and coal) †	6,899.49	**0.004%**

SOCIAL COST OF GREENHOUSE GASES

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. This subsection provides estimates of the monetary value of changes in GHG emissions that could result from selecting each alternative. Such analysis should not be construed to mean a cost determination is necessary to address potential impacts of GHGs associated with specific alternatives. While these numbers provide a monetized measure of the net harm to society from emissions, they do not constitute a complete cost-benefit analysis of management actions under considerations and do not present a direct comparison with other impacts discussed in this document. SC-GHG estimates are provided only as a useful measure of the benefits of GHG emissions reductions to inform agency decision-making.

The best currently available estimates of the SC-GHG for use in Department of Interior decision-making and/or analysis are those cited in the Environmental Protection Agency's Final Rule of March 8, 2024, 89 Fed. Reg. 16820, 17018-20. These estimates reflect recent advances in the scientific literature on climate change and its economic impacts and incorporate recommendations made by the National Academies of Science, Engineering, and Medicine (National Academies 2017). Technical documentation and additional supporting documents regarding these estimates are available on the EPA webpage[26].

The EPA's SC-GHG estimates were developed using complex models which simulates how changes in GHG emissions may affect global temperatures, sea level rise, and other biophysical processes; how these changes may affect human health and infrastructure, as well as the supply of energy, food, and water; and monetize the market and nonmarket impacts associated with these effects. The modular approach employed by EPA to estimate the SC-GHG also includes a discounting module which discounts the stream of future net climate damages back to the year when the additional unit of emissions was released.

[26] https://www.epa.gov/environmental-economics/scghg.

EPA discounts the future costs of emissions to the emission year using three different near-term target rates (1.5%, 2.0%, and 2.5%) to reflect uncertainty over the starting rate (EPA 2023m). 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 SC-GHGs associated with estimated emissions from the lease sale are reported in Table 3.26. These estimates represent the present value of future market and nonmarket costs associated with CO_2, CH_4, and N_2O emissions, discounted to 2024 by applying a constant discount rate equal to the near-term target rate to discount costs from the emissions year. Estimates are calculated using EPA's Workbook and based on BLM's estimates of emissions in each year. They are rounded to the nearest $1 million.

Table 3.26. SC-GHGs Associated with Future Potential Development.

Present Value of SC-GHG	Social Cost of GHGs (millions, 2023$)		
	2.5% near-term Ramsey discount rate	2.0% near-term Ramsey discount rate	1.5% near-term Ramsey discount rate
Present cost of SC-GHG (March 2019 Leases -14 wells)	$340.88	$558.59	$959.76
Present cost of SC-GHG (June 2019 Leases – two wells)	$48.72	$79.84	$137.15
Present cost of SC-GHG (March and June 2019 Leases – 16 wells)	$389.42	$638.24	$1,096.64

Source: EPA 2023m.

No Action Alternative

Under the No Action Alternative, the BLM would not affirm the issuance of the leases. However, in the absence of a Land Use Plan Amendment closing the lands to leasing, they could be considered for inclusion in future lease sales. Although no new GHG emissions would result under the No Action Alternative, the national and global demand for energy is not expected to differ regardless of BLM decision making.

The BLM does not have a model to estimate energy market substitutions at a spatial resolution needed for this onshore production scenario. Reductions in oil and natural gas produced from federal leases may be partially offset by non-federal production (state and private) in the United States (in which case the indirect GHG emissions would be similar), or overseas, in which case the GHG emissions could be higher, to the extent environmental protection requirements for production are less vigorous, and the produced energy would need to be physically transported into the United States. There may also be substitution of other energy resources to meet energy demand. These substitution patterns will be different for oil and gas because oil is primarily used for transportation, while natural gas is primarily used for electricity production and manufacturing, and to a lesser degree by residential and commercial

users (EIA 2023b). Coal and renewable energy sources are stronger substitutes for natural gas in electricity generation. The effect of substitution between different fuel sources on indirect GHG emissions depends on the replacement energy source. For example, coal is a relatively more carbon-intense fuel than natural gas and hydroelectricity is the least carbon-intense energy source (see Table 10-3 of the Annual GHG Report). In the transportation sector, alternatives to oil are likely to be less carbon-intensive.

Finally, substitution across energy sources or oil and gas production from other locations may not fully meet the energy needs that would otherwise have been realized through production from leases. Price effects may lower the market equilibrium quantity demanded for some fuel sources. This would lead to a reduction in indirect GHG emissions. These three effects are likely to occur in some combination under the No Action Alternative, but the relative contribution of each is unknown. Regardless, GHG emissions under the No Action Alternative are not expected to be zero.

NO ACTION ALTERNATIVE

Under the No Action Alternative, the BLM would not offer any of the nominated parcels for competitive leasing in the lease sale. However, in the absence of a Land Use Plan Amendment closing the lands to leasing, they could be considered for inclusion in future lease sales. Although no new GHG emissions resulting from new federal oil and gas development would occur under the No Action Alternative, the national and global demand for energy is not expected to differ regardless of BLM's decision.

The BLM does not have a model to estimate energy market substitutions at a spatial resolution needed for this onshore production scenario. Reductions in oil and natural gas produced from federal leases may be partially offset by non-federal production (state and private) in the United States (in which case the indirect GHG emissions would be similar), or overseas, in which case the GHG emissions would likely be higher, to the extent environmental protection requirements for production are less vigorous, and the produced energy would need to be physically transported to the United States. There may also be substitution of other energy resources to meet energy demand. These substitution patterns will be different for oil and gas because oil is primarily used for transportation, while natural gas is primarily used for electricity production and manufacturing, and to a lesser degree by residential and commercial users (EIA 2023a). Coal and renewable energy sources are stronger substitutes for natural gas in electricity generation. The effect of substitution between different fuel sources on indirect GHG emissions depends on the replacement energy source. For example, coal is a relatively more carbon intense fuel than natural gas, and hydroelectricity is the least carbon intense energy source (see Table 10-3 of the Annual GHG Report [BLM 2023c]). In the transportation sector, alternatives to oil are likely to be less carbon intensive.

Finally, substitution across energy sources or oil and gas production from other locations may not fully meet the energy needs that would otherwise have been realized through production from these leases. Price effects may lower the market equilibrium quantity demanded for some fuel sources, which would lead to a reduction in indirect GHG emissions. These three effects are likely to occur in some combination under the No Action Alternative, but the relative contribution of each is unknown. Regardless, GHG emissions under the No Action Alternative are not expected to be zero.

3.6.2.3 *Cumulative Effects*

The analysis of GHGs contained in this EA includes estimated emissions from the lease 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 Section 7 of the Annual GHG Report (BLM 2023c). 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 the Annual GHG Report provide estimates of foreseeable short-term and projected long-term GHG emissions from activities across the BLM's federal mineral estates. The foreseeable short-term methodology includes a trends analysis of: 1) leased federal lands that are held-by-production,[27] 2) approved APDs, and 3) leased lands from competitive lease sales occurring 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 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.

Table 3.31 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 (BLM 2023c).

Table 3.31. Greenhouse Gas Emissions from Past, Present, and Reasonably Foreseeable Federal Onshore Lease Development (Mt CO_2e)

State	Existing Wells (Report Year)	Existing Wells (Projected)	Approved APDs	New Leasing	Short-Term Totals	Long-Term Totals
Alabama	0.51	7.56	0.00	0.18	7.74	15.28
Alaska	1.31	19.47	23.13	34.70	77.31	39.67
Arizona	0.00	0.00	0.00	0.00	0.00	0.00
Arkansas	0.55	8.72	0.24	0.24	9.19	16.63
California	4.92	67.90	5.93	2.13	75.96	151.15
Colorado	46.16	399.35	30.80	23.95	454.10	1,395.90
Idaho	0.00	0.00	0.00	0.29	0.30	0.01
Illinois	0.01	0.11	0.00	0.02	0.13	0.26
Indiana	0.00	0.00	0.00	0.02	0.02	0.00
Kansas	0.26	3.81	0.00	0.11	3.92	7.80
Kentucky	0.01	0.07	0.00	0.03	0.10	0.25
Louisiana	3.84	48.54	44.95	13.11	106.60	115.95

[27] The term "held-by-production" is 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.

State	Existing Wells (Report Year)	Existing Wells (Projected)	Approved APDs	New Leasing	Short-Term Totals	Long-Term Totals
Maryland	0.00	0.00	0.00	0.00	0.00	0.00
Michigan	0.07	1.36	0.00	0.58	1.94	2.11
Mississippi	0.12	1.59	0.38	0.38	2.35	3.62
Montana	2.52	25.68	0.42	12.63	38.73	77.12
Nebraska	0.02	0.22	0.00	0.03	0.25	0.47
Nevada	0.13	1.01	0.01	0.19	1.22	4.07
New Mexico	326.00	2,318.83	745.21	119.12	3,183.17	9,961.81
New York	0.00	0.01	0.00	0.00	0.01	0.01
North Dakota	33.32	279.03	57.62	3.57	340.22	1,020.91
Ohio	0.40	3.83	0.00	4.64	8.47	12.20
Oklahoma	1.25	12.23	0.95	1.66	14.83	37.81
Oregon	0.00	0.00	0.00	0.12	0.12	0.00
Pennsylvania	0.00	0.06	0.00	0.67	0.72	0.12
South Dakota	0.11	1.77	0.11	0.11	1.98	3.23
Tennessee	0.00	0.00	0.00	0.00	0.00	0.00
Texas	3.31	36.52	19.00	1.97	57.49	99.95
Utah	13.90	175.34	16.33	36.75	228.41	421.63
Virginia	0.01	0.14	0.00	0.03	0.16	0.27
West Virginia	0.00	0.06	0.00	0.59	0.65	0.14
Wyoming	103.34	920.76	178.16	317.98	1,416.91	3,134.55
Total Onshore Federal	**542.07**	**4,333.97**	**1,123.24**	**575.80**	**6,033.00**	**16,522.92**

Source: BLM Annual GHG Report (BLM 2023c: Section 7)

As detailed in the 2022 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). The 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 CO_2 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 (°C) above pre-industrial temperatures. The second "middle of the road" scenario leaves global CO_2 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°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.

Recent short-term energy outlook reports (STEO) published by the EIA (EIA 2024) predicts that the world's oil and gas supply and consumption will increase over the next 18 to 24 months. The latest 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 2 years:

- U.S. liquid fuels consumption is projected to increase to 20.40 million barrels per day (b/d) in 2024, up from 20.25 million b/d in 2023.
- U.S. crude oil production is expected to average 13.19 million b/d in 2024 and rise to 13.65 million b/d in 2025.
- U.S natural gas consumption is expected to average 89.68 billion cubic feet/day (Bcf/d) in 2024, decreasing slightly to 89.21 Bcf/d in 2025.
- U.S. liquid natural gas exports are expected to increase from 11.9 Bcf/d in 2023 to 12.34 Bcf/d in 2024 and 14.43 Bcf/d in 2025.
- U.S. coal production is expected to total 496.6 million short tons (MMst) in 2024 and 465.8 MMst in 2025 and decrease to 15% of total U.S. electricity generation in 2024 compared to 17% in 2023, driven by the ongoing retirement of coal-fired generating plants.

Generation from renewable sources will make up an increasing share of total U.S. electricity generation, rising from 21% in 2023 to 24% in 2024. 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) 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 2024). 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 (EIA 2023a) 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 CO_2 emissions are expected to fall 25% to 38% below the 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 GHG Report (BLM 2023c).

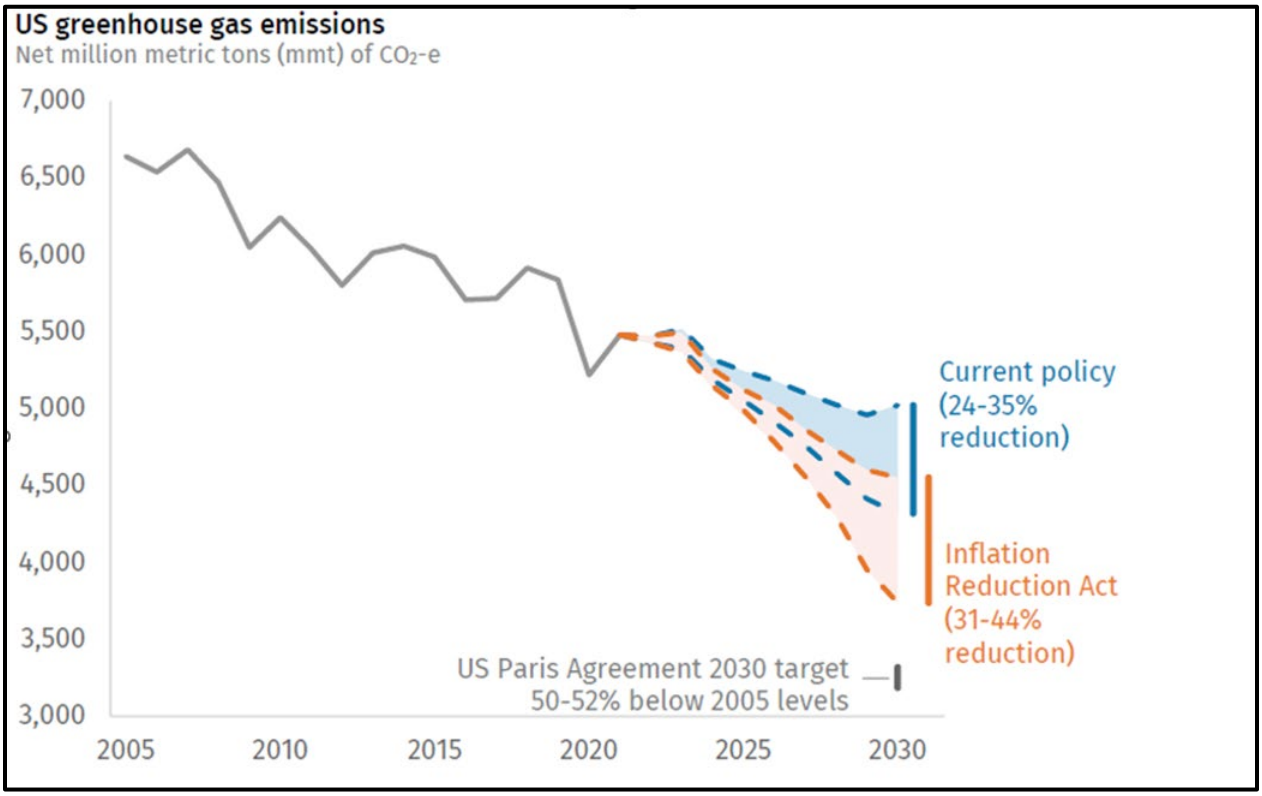
Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad" (January 27, 2021), directs the executive branch to establish policies or rules that put the United States on a path to achieve carbon neutrality, economywide, by no later than 2050. This goal is consistent with IPCC's recommendation to reduce net annual global CO_2 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 estimate 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 (see Section 9.1 of the Annual GHG Report [BLM 2023c]). The IPCC Special Report on Global Warming of 1.5ºC (IPCC 2020) 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. At present, no national or federal agency carbon budgets have been established, 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 CEQ 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 (BLM 2023c) 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, represent approximately 1.37% of the remaining global carbon budget of 380 gigatonnes of CO_2 needed to limit global warming to 1.5°C.

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 of 2022 (IRA), the EIA International Energy Outlook expects renewable energy consumption to double between 2020 and 2050 and nearly equal liquid fuels consumption by 2050. The United States 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 IRA. Figure 3.4 shows the projected short-term emissions reductions associated with the IRA.



Source: Rhodium Group (2022). The range reflects uncertainty around future fossil fuel prices, economic growth, and clean technology costs. It corresponds with high- 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 (BLM 2023c).

Figure 3.4. Projected short-term emissions reductions associated with the Inflation Reduction Act.

MITIGATION 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) 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) 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, OOOb) 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 (BLM 2023c).

At the state level, the New Mexico's EMNRD published the NMOCD Statewide Natural Gas Capture Requirements (Waste Prevention Rule) (NMAC 19.15.27) on May 25, 2001, as part of the New Mexico statewide enforceable regulatory framework to secure reductions in oil and gas sector emissions and to prevent natural gas waste from new and existing sources. Key provisions include prohibition of unnecessary venting and flaring of waste natural gas where it is technically feasible to route the gas to a pipeline or to use this gas for some other beneficial purpose (such as on-site fuel consumption). In all cases, operators must flare rather than vent natural gas except where this is technically infeasible or would pose a safety risk. These provisions will reduce VOC emissions due to stringent limitations on natural gas venting which results in un-combusted VOC emissions. Additionally, it proposes that natural gas be recovered and reused rather than flared, which would result in reductions of VOCs, NO_X, CO, SO_2, GHGs, and particulate matter emissions. The NMED developed the "Oil and Natural Gas Regulation for Ozone Precursors" (NMAC 20.2.50), published on July 26, 2022, with an effective date of August 5, 2022. Approximately 50,000 wells and associated equipment will be subject to this regulation. It is anticipated the regulation will annually reduce VOC emissions by 106,420 tons, NO_X emissions by 23,148 tons, and CH_4 emissions by 200,000 to 425,000 tons. The regulation includes emissions reduction requirements for compressors, engines and turbines, liquids unloading, dehydrators, heaters, pneumatics, storage tanks, and pipeline inspection gauge launching and receiving. A description of federal and state rules and regulations can be found in Section 2 of the ARTR (BLM 2023a), incorporated by reference.

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-site 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 BMPs designed to mitigate impacts to air quality, and by extension climate change, 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 wells. Analysis and approval of future development may include the application of BMPs within BLM's authority, included as COAs, to reduce or mitigate impacts to air quality, and by extension climate change. 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 (BLM 2023c).

3.6.3 Issue 3: Water Use and Quantity

How would future potential development of the nominated lease parcels affect surface and groundwater quantity?

The analysis area for this issue is the total area of San Juan, Sandoval, Rio Arriba, and McKinley Counties, which collectively make up the New Mexico portion of the San Juan Basin. This analysis area is used because water sources used to support future potential development of the nominated lease parcels would likely be sourced from these four counties. The following analysis summarizes information contained in the *BLM Water Support Document for Oil and Gas Development in New Mexico*; hereafter referred to as the Water Support Document (BLM 2023b) and incorporated by reference. This analysis is also supported by the Mancos-Gallup RFD Scenario and the RFD for the RPFO (Crocker and Glover 2018, 2019). Water use for development of the nominated lease parcels is assumed to primarily come from groundwater sources based on previous oil and gas development in the area.

Water uses associated with development of the nominated lease parcels would occur during the 30- to 60-day well construction and completion period (such as hydraulic fracturing), the 20-year operation period (e.g., water use associated with dust control), and interim and final reclamation. While most of the water use associated with oil and gas development is expected to occur within a 30- to 60- day well construction and completion period, the effect of this use on groundwater aquifers is expected to last until recharge occurs. Because of uncertainty about water sources and recharge rates, it is assumed that all water use associated with oil and gas development is likely to have a long-term effect. Additionally, the ability for aquifer recharge may be affected by drought conditions associated with climate change.

3.6.3.1 *Affected Environment*

CURRENT TOTAL WATER USE IN THE ANALYSIS AREA

The USGS report, *Estimated Use of Water in the United States in 2015* (Dieter et al. 2018), lists total water withdrawals across eight water use categories: aquaculture, domestic, industrial, irrigation, livestock, mining, public water supply, and thermoelectric power. Water use for 2015 is summarized in Table 3.32 for the eight water use categories in the four counties within the analysis area. Irrigation was the largest category of water use in all counties, accounting for an average of 79% (384,817 acre-feet [AF]) of the total water withdrawal for the analysis area (486,660 AF). Approximately 9% (50,008 AF) of the total water use was from groundwater. Mining (which includes oil and gas development) comprised

approximately 2% of water withdrawals. Approximately 77% of mining-related water use (8,934 AF per year) was from groundwater.

Table 3.32. 2015 New Mexico Portion of San Juan Basin Water Use by Category

Category	Surface Water			Groundwater			Total Withdrawals			
	Fresh (AF)	Saline (AF)	Total (AF)	Fresh (AF)	Saline (AF)	Total (AF)	Fresh (AF)	Saline (AF)	Total (AF)	Percent Total Use
Aquaculture	0	0	0	4,641	0	4,641	4,641	0	4,641	<1%
Domestic	0	0	0	8,979	0	8,979	8,979	0	8,979	2%
Industrial	0	0	0	2,634	0	2,634	2,634	0	2,634	<1%
Irrigation	381,241	0	381,241	3,576	0	3,576	384,817	0	384,817	79%
Livestock	437	0	437	986	0	986	1,424	0	1,424	<1%
Mining	2,724	0	2,724	3,677	5,257	8,934	6,401	5,257	11,658	2%
Public water supply	21,613	0	21,613	17,958	0	17,958	39,571	0	39,571	8%
Thermoelectric power	30,637	0	30,637	2,298	0	2,298	32,935	0	32,935	7%
Total	**436,652**	**0**	**436,652**	**44,750**	**5,257**	**50,008**	**481,402**	**5,257**	**486,660**	**100%**

Source: BLM (2023b)

Note: The mining category (highlighted in dark gray) represents the category into which the Proposed Action falls.

See the Water Support Document (BLM 2023b) for graphical representation of these data, as well as comparisons with water use across the state of New Mexico.

CURRENT WATER USE ASSOCIATED WITH OIL AND GAS DEVELOPMENT

As part of oil and gas development, water is used for drilling fluid preparation and makeup water for completion fluids, in well stimulation (of which the most common method is hydraulic fracturing), as rig wash water, as coolant for internal combustion engines, for dust suppression on roads or well pads, and for equipment testing. Water uses for oil and gas development in the analysis area are typically sourced from groundwater. Of these uses, hydraulic fracturing activities use the most water. The amount of water used for hydraulic fracturing is dependent on many factors, including the geologic formation.

On average, the water use associated with hydraulic fracturing for vertical wells in the New Mexico portion of the San Juan Basin is 0.537 AF per well (Crocker and Glover 2018). Horizontal wells require more water than vertical wells for well completion. The Mancos-Gallup RFD Scenario (Crocker and Glover 2018) reported that horizontal wells in the New Mexico portion of the San Juan Basin require on average approximately 3.13 AF of water. Recently, however, in association with changes in production stimulation techniques, water use per horizontal well has been increasing.

Oil and gas operators are required by the State of New Mexico to disclose water use to FracFocus (per NMAC 19.15.16), a national hydraulic fracturing chemical registry managed by the GWPC and Interstate Oil and Gas Compact Commission to provide objective information on hydraulic fracturing. The BLM examined FracFocus data reported for calendar years 2014 to 2022 to ascertain actual water use in the analysis area (Table 3.33). The data show that total water use (federal and non-federal) for hydraulic fracturing of oil and gas wells in the New Mexico portion of the San Juan Basin has increased from 129 AF in 2014 to 1,326 AF in 2022, with a corresponding basin-wide average water use per well increase from 2.4 AF per well in 2014 to 10.3 AF per well in 2022 (BLM 2023b). Based on the most recent 3 years of data (2020–2022), the 3-year average is 10.3 AF per well. This is due to the higher

volume of wells, the likelihood that horizontal wells are being drilled to longer lengths in the intervening time, and the continued use of hydraulic fracturing technologies in well drilling and completion.

Table 3.33. Actual Water Use by Oil and Gas Wells for Hydraulic Fracturing in the Analysis Area for Calendar Years 2014 to 2022

Year	Federal Water Use (AF)	Non-Federal Water Use (AF)	Total Water Use (AF)	Federal Water Use (%)	Average Water Use per Well (AF)	Total Number of Wells Reported to Frac Focus
2014	73	56	129	57%	2.4	47
2015	83	255	338	25%	3.8	89
2016	85	26	110	77%	2.7	38
2017	228	50	278	82%	4.4	62
2018	375	281	657	57%	4.6	136
2019	92	69	161	57%	1.7	90
2020	51	0	51	100%	5.7	9
2021	551	120	671	82%	14.9	45
2022	1,172	154	1,326	88%	10.3	123
Total	2,710	1,011	3,721	69%	**10.3***	639

Source: BLM (2023b). The analysis contained in this table provides percentage contribution rounded to one decimal point.
Note: Analysis area is San Juan, McKinley, Rio Arriba, and Sandoval Counties. The table does not include any well data from the RPFO portion of analysis area since no wells in RPFO reported water usage to FracFocus.

*3-year average (2020–2022).

While the FracFocus database is an excellent tool for identifying well completions, FracFocus does not currently differentiate between wells that are new completions or recompletions of previously drilled wells. This discrepancy can skew water use statistics, as recompletions typically use less water than new completions. The Water Support Document (BLM 2023b) presents additional well information compiled from BLM records, NMOCD, and aggregated with the FracFocus data to provide a more detailed analysis of water use by well type (new completion versus recompletion and completion method). From 2014 to 2022, recompletions of previously existing wells used an average of 0.3 AF per well and completions of vertical wells used an average of 0.2 AF per well. Water use associated with new completions of nitrogen and slickwater wells used an average of 3.98 and 45.2 AF per well, respectively.

Based on the data sources summarized above, actual water use quantities reported from 2014 through 2022 vary from an average of 0.2 to 10.3 AF per well, depending on the type of well and data sources being reviewed. The BLM considers the estimate of 0.537 AF as the most accurate estimate of current water use for hydraulic fracturing for a vertical well in the New Mexico portion of the San Juan Basin; this estimate is consistent with the Mancos-Gallup RFD Scenario (Crocker and Glover 2018) and is slightly higher than 2014–2022 water use estimates for vertical wells only. The BLM considers the estimate of 4.84 AF as the most accurate estimate of current water use for a horizonal well in the New Mexico portion of the San Juan Basin; this estimate is consistent with the Mancos-Gallup RFD Scenario (Crocker and Glover 2018). Additional information on estimated water use is contained in the Water Support Document (BLM 2023b).

POTENTIAL WATER SOURCES

Most water used in oil and gas activities (reported to the NMOSE as mining activities) in the counties that comprise the FFO is currently from groundwater. The Water Support Document (BLM 2023b) indicates

that sources of groundwater can be found in nearly every area of the FFO. Four potential sources of groundwater are in the analysis area: the Mesaverde aquifer, the Rio Grande aquifer, the Uinta-Animas aquifer, and the Entrada Sandstone aquifer. Water yields in these areas vary, but most aquifers yield less than 20 gallons per minute (BLM 2003). Aquifers that are known to yield sufficient quantities of water are usually found within the sandstone units of the Jurassic, Cretaceous, and Tertiary periods (BLM 2003). Aquifers that have the potential to yield 100 gallons per minute include the Ojo Alamo Sandstone, the Nacimiento Formation, and the San Jose Formation, all of which are within the greater Uinta-Animas aquifer (BLM 2003). However, water used in hydraulic fracturing may also originate from regulated and controlled surface water sources. Principal surface water drainages in the analysis area are the San Juan River (which is impounded at Navajo Dam), the Animas River, and the La Plata River (Dieter et al. 2018).

While much of the water use associated with oil and gas development is expected to occur within a 30- to 60-day well construction and completion period (such as hydraulic fracturing), the effect of this use on groundwater aquifers is expected to last until recharge occurs. Long-term water requirements during operation would depend on the project but include the use of water as coolant for internal combustion engines and dust suppression on roads or well pads. Although the main sources of recharge for aquifers in the analysis area are generally understood (e.g., upland areas, precipitation and snowmelt from surrounding mountains and valleys, or surface exposures) no additional information is available about recharge rates (BLM 2023b). In light of this uncertainty, the BLM assumes that water use associated with oil and gas development is likely to be a long-term effect, and the ability for aquifer recharge may be affected by drought conditions associated with climate change.

San Juan Basin oil and gas operators have recently included plans to use multiple hydraulic fracturing methods including slickwater fracturing technology. The two general water types that may be used for slickwater stimulation are categorized as “potable/fresh” and “non-potable.” Any water that has TDS greater than 1,000 ppm has been defined as “non-potable” by the State of New Mexico (New Mexico Statute Annotated 1978, § 72-12-25), and the BLM has identified anything less than 10,000 ppm to be protected in the casing rule of the BLM’s Onshore Order #2 (BLM 1988). Non-potable water is outside the appropriative processes and is mainly diverted for mineral exploration purposes. The higher allowable TDS levels that are acceptable for slickwater stimulation expand the possible water sources beyond those that are traditionally used (e.g., surface water or groundwater) into non-traditional sources of water (e.g., non-potable groundwater sources). Recently, the NMOSE has approved permits to drill wells within the San Juan Basin to withdraw non-potable connate water (groundwater) from the Entrada Sandstone Formation for use as a potential source of water for slickwater stimulation operations. The Entrada Sandstone Formation has also been used for nitrogen simulations. Water contained in the Entrada Formation typically measures much greater than 1,000 TDS, is highly saline water (Kelley et al. 2014), and as such, is considered nonpotable and has not been declared an administrative aquifer by NMOSE. The NMOSE is the agency responsible for water withdrawal permitting actions. Their Notice of Intent process includes a model-based evaluation of the potential effects of proposed withdrawals and the identification of possible requirements for applicants to obtain water rights to offset any depletions identified in NMOSE’s analyses prior to applicants commencing diversions.

Other sources of nonpotable water that can be used in stimulation are flowback fluid and produced water. Flowback fluid is a mixture of water and small amounts of chemicals and other proppants that flow back through the wellhead directly after stimulation activities. Generally, 10% to 40% of the initial volume used for stimulation activities returns as flowback fluid; of this flowback fluid, 10% to 40% is nonpotable water that may be used in future stimulation activities. Produced water is the outcome of a process involving naturally occurring water that exists in a formation. It is targeted for mineral extraction and is produced as a byproduct, thereby becoming produced water. The Water Support Document (BLM 2023b) contains additional information potential water sources that may be used.

REASONABLY FORESEEABLE ENVIRONMENTAL TRENDS AND PLANNED ACTIONS

The 2018 RFD for the FFO planning area projects the development of 3,200 wells (2,300 horizontal wells and 900 vertical wells) in the FFO portion of the San Juan Basin between 2018 and 2037, or approximately 160 wells per year (Crocker and Glover 2018). Future developments, such as the development expected under the Proposed Action, is already considered in this scenario. Based on vertical and horizontal water use estimates contained in the 2018 RFD and refined through a review 2018 FracFocus water use data, consumptive water use required for hydraulic fracturing of the wells projected in the 2018 RFD is currently estimated at 11,685 AF, or about 580 AF in any given year. Development of the 2018 RFD would also require some water for drilling, dust control, and construction of reasonably foreseeable transmission lines and pipelines (BLM 2023b).

In 2019, a new RFD for the RPFO was published (Crocker and Glover 2019). This RFD includes a portion of Sandoval County which overlaps the RPFO portion of the MGPAA. Sandoval County is the only county addressed in the RFD because it is the only county in the RPFO with consistent oil and gas development. The 2019 RFD forecasted development of 200 federal and non-federal oil and gas wells (160 vertical wells and 40 horizontal wells) over a 20-year period from 2020 to 2039 (BLM 2023b). The estimated total water used for hydraulic fracturing of the wells projected in the 2019 RFD is 307.4 AF, or about 15.4 AF in any given year. The water use projections assume that one vertical well will require 0.32 AF and one horizontal well with a 1-mile lateral will require 6.44 AF (Crocker and Glover 2019). Development of the 2019 RFD would also require some water for drilling, dust control, and construction of reasonably foreseeable transmission lines and pipelines (BLM 2023b).

If more water-intensive stimulation methods (e.g., slickwater fracturing) are implemented or if laterals become longer, or if the number of wells continue to increase, aggregate water use could increase from estimates provided in the Water Support Document (BLM 2023b). Alternatively, water use estimates could be lower if produced water is reused or recycled for use in hydraulic fracturing or if methods such as nitrogen completions are implemented. Nitrogen stimulation is common in the FFO, comprising approximately 47% to 100% of annual well completions in the FFO between 2014 and 2022 (BLM 2023b).

The projected annual use associated with the RFD scenario comprises about 0.13% of analysis area's 2015 total water withdrawals (486,660 AF, which already includes past and present water use) (BLM 2023b). Irrigation would still use the most water within the analysis area (currently 79% of all water use within the analysis area).

No other reasonably foreseeable environmental trends and planned actions with substantial use have been identified. No reasonably foreseeable mining projects would contribute to aggregate water withdrawals within the San Juan Basin. Some water use would be required during construction and operations of reasonably foreseeable transmission lines and pipelines; these uses are addressed in the Water Support Document (BLM 2023b).

Predicted effects from climate change for the analysis area include intensified droughts (Mankin et al. 2021). A Bureau of Reclamation report (Bureau of Reclamation 2013) predicts decreases in overall water availability by one-quarter to one-third through the end of the twenty-first century for the Upper Rio Grande Basin (southern Colorado to central southern New Mexico).

3.6.3.1.1 Environmental Effects

The fourteen March 2019 Lease Sale parcels are expected to result in three vertical and 11 horizontal wells while the two June 2019 Lease Sale parcels are expected to result in two horizonal wells, see Table 3.1.

Drilling and completion of the 3 vertical and 13 horizonal wells on the nominated lease parcels (March and June 2019 parcels combined) are estimated to use approximately 64.53 AF of groundwater; or 54.85 AF for the March 2019 parcels, and 9.68 AF of groundwater for the June 2019 parcels. This calculation is based on a factor of 0.537 AF per vertical well, and 4.84 AF per horizonal well which the BLM considers a reasonable current estimate of water use associated with drilling and completion of these well types within the analysis area (BLM 2023b). If more water-intensive stimulation methods (e.g., slickwater fracturing) are implemented or if laterals become longer, water use could increase from estimates provided in the Water Support Document (BLM 2023b). Water use estimates could be lower if produced water is reused or recycled, or if less water-intensive stimulation methods are used (e.g., nitrogen) in hydraulic fracturing. Water sourced from outside of the geological formation that is used in hydraulic fracturing, which remains in the geological formation after hydraulic fracturing is complete, is unlikely to be recovered for other uses (Kondash et al. 2018).

Assuming that all wells are developed in the same year, groundwater water use associated with future potential development of the March and June 2019 leases would result in a 0.013% increase over the 2015 total water use in the analysis area (486,660 AF), a 0.13% increase over the 2015 total groundwater use in the analysis area (50,008 AF) and would result in a 0.55% increase over 2015 water use in the mining category for the analysis area (11,658 AF).

Assuming that all wells are developed in the same year, groundwater water use associated with future potential development of the March 2019 would result in a 0.011% increase over the 2015 total water use in the analysis area (486,660 AF), a 0.11% increase over the 2015 total groundwater use in the analysis area (50,008 AF) and would result in a 0.47% increase over 2015 water use in the mining category for the analysis area (11,658 AF).

Assuming that all wells are developed in the same year, groundwater water use associated with future potential development of the June 2019 leases would result in a 0.002% increase over the 2015 total water use in the analysis area (486,660 AF), a 0.13% increase over the 2015 total groundwater use in the analysis area (50,008 AF) and would result in a 0.55% increase over 2015 water use in the mining category for the analysis area (11,658 AF).

Assuming a 20-year development scenario for the Proposed Action (consistent with the RFD time frame), the water use associated with development of the combine sale lease parcels, March lease parcels, and June lease parcels would be approximately 3.23 AF, 2.74 AF and 0.48 AF for any given year, respectively.

Annual water use associated with future potential development of the combined sales lease parcels would result in a 0.013% increase of the analysis area total water use (486,660 AF), 0.0004% of the analysis area total groundwater use (50,008 AF), and a 0.554% increase over 2015 water use in the mining category for the analysis area (11,658 AF). The total estimated water use for drilling and completion of the 16 wells in the nominated lease parcels in a single year (3.23 AF) represents approximately 0.24% of the 2022 oil and gas water use reported to FracFocus (1,326 AF) for the FFO (see Table 3.22).

Annual water use associated with future potential development of the March 2019 lease parcels would result in a 0.001% increase of the analysis area total water use (486,660 AF), 0.005% of the analysis area

total groundwater use (50,008 AF), and a 0.024% increase over 2015 water use in the mining category for the analysis area (11,658 AF). The total estimated water use for drilling and completion of the 14 wells in the nominated lease parcels in a single year (2.74 AF) represents approximately 0.21% of the 2022 oil and gas water use reported to FracFocus (1,326 AF) for the FFO (see Table 3.22).

Annual water use associated with future potential development of June 2019 lease parcels would result in a 0.0001% increase of the analysis area total water use (486,660 AF), 0.001% of the analysis area total groundwater use (50,008 AF), and a 0.004% increase over 2015 water use in the mining category for the analysis area (11,658 AF). The total estimated water use for drilling and completion of the two wells in the nominated lease parcels in a single year (.48 AF) represents approximately 0.04% of the 2022 oil and gas water use reported to FracFocus (1,326 AF) for the FFO (see Table 3.22).

Water use associated with future potential development of the combined proposed lease parcels (64.53 AF) would comprise 11.13% of annual RFD water use (580 AF) and 0.55% of total water use associated with the RFD (11,615 AF). Water use associated with future potential development of the proposed March 2019 lease parcels (54.85 AF) would comprise 9.46% of annual RFD water use (580 AF) and 0.47% of total water use associated with the RFD (11,615 AF). Water use associated with future potential development of the proposed June 2019 lease parcels (.48 AF) would comprise 0.083% of annual RFD water use (580 AF) and 0.004% of total water use associated with the RFD (11,615 AF).

The demand from the future potential development of the nominated lease parcel scenarios (64.53 AF, 54.85 AF and 9.68) is negligible when contrasted with the estimated water demand of the RFD (11,615 AF over 20 years, or 580 AF in any given year), the 2015 water use in the analysis area (486,660 AF) and the demands of other sectors in the analysis area such as irrigation (384,817 AF in 2015) and mining (11,658 AF in 2015).

Water used for the purpose of oil and gas drilling, completion, and operations would be purchased legally from those who hold water rights in or around the New Mexico portion of the San Juan Basin.
The transaction would be handled by the NMOCD, as well as the NMOSE. All water uses would be evaluated at the time of proposed lease development in site-specific environmental review documentation and subject to standard lease terms and conditions and site-specific mitigation. Table 3-8 of the Water Support Document (BLM 2023b) identifies the potential sources of groundwater in the analysis area.

Produced water associated with development of the lease parcels is estimated at approximately 1,330,000 bbl of water (70,000-140,000 bbl per well), see Table 3.1. Produced water would be either recycled, reused, or disposed of in accordance with all applicable federal and state laws and regulations. Disposal of produced water would occur at regulated and permitted commercial facilities (such as SWD wells).

3.6.3.2 *Mitigation Measures and Residual Effects*

Public concern about water use from hydraulic fracturing is especially high in semiarid regions such as the tri-county analysis area, where water withdrawals associated with hydraulic fracturing make up most oil and gas–related water use. Overall, there has been a concerted effort to increase the use of alternative water sources such as brackish water or recycling produced water, minimizing the extent to which oil and gas–related consumptive water uses contribute to the strain on local freshwater resources (Kondash et al. 2018). The BLM encourages the use of recycled water in hydraulic fracturing techniques, and in 2019, the State of New Mexico passed the Produced Water Act, which encourages oil and gas producers to reuse produced water, when possible, rather than relying on freshwater sources for oil and gas extraction. Additionally, New Mexico has promulgated new rules on produced water stemming from passage of the

2019 Produced Water Act (NMED 2021a).[28] The rules were developed to encourage the recycling, reuse, or disposition of produced water while also affording reasonable protection against contamination of fresh water and establish procedures by which persons may transport and dispose of produced water, drilling fluids, and other liquid oil field waste. Such rules do not change the requirement that development of a federal lease must comply with all applicable federal and state laws and regulations.

Recent studies indicate that the water used for hydraulic fracturing may be retained within the shale formation, with only a small fraction of the fresh water injected into the ground returning as flowback water; water returning to the surface is highly saline, difficult to treat, and often disposed of through deep-injection wells (Kondash et al. 2018). In 2019, NMED entered into a memorandum of understanding with New Mexico State University to develop new technologies for treating produced water to inform future policies for produced water reuse; an updated memorandum of understanding was signed on November 10, 2022 (NMED 2022).

CHAPTER 4. CONSULTATION AND COORDINATION

The following consultation and coordination efforts with tribes, individuals, organizations, and agencies were conducted for the proposed leasing actions.

4.1 ENDANGERED SPECIES ACT CONSULTATION

BLM FFO biologists have reviewed the proposed leasing and determined the Proposed Action would comply with threatened and endangered species management guidelines outlined in the 2002 Biological Assessment for the 2003 Farmington RMP (BLM 2002) and in accordance with the requirements of FLPMA and NEPA.

Additionally, in August 2024 the BLM also completed a review of the current species listings within the vicinity of the nominated lease parcels using the USFWS IPaC system for Rio Arriba, Sandoval, and San Juan Counties (USFWS 2023). No federally listed fish species were found to have potential to be present on the nominated lease parcels. Based on the understanding that water use for drilling and operations would be properly permitted from existing legal sources (i.e., no new water depletions), no federally listed fish species would be impacted by future potential development of the lease parcels. Therefore, outside of the programmatic consultation, no further consultation with the USFWS is required at this stage for these species.

BLM would initiate Section 7 consultation with the USFWS in compliance with the ESA for species not previously analyzed in the 2002 Biological Assessment (BLM 2002) if during site selection federally listed species are found to have a potential to be present or affected during lease development. If during site selection federally listed species are found to have a potential to be affected during lease development, the BLM would initiate Section 7 consultation with the USFWS in compliance with the ESA.

While federal regulations and policies require the BLM to make its public land and resources available on the basis of the principle of multiple uses, it is BLM policy to conserve special status species and their habitats, and to ensure that actions authorized by the BLM do not contribute to the need for the species to become listed as threatened or endangered by the USFWS. Official species lists, whether obtained via

[28] The State of New Mexico House Bill 546, which included the Produced Water Act, went into effect July 1, 2019. Amendments to NMAC 19.15.34, Produced Water, Drilling Fluids and Liquid Oil Field Waste, became effective on October 13, 2020.

IPaC or local USFWS offices, are valid for 90 days. After 90 days, project proponents should confirm their results on IPaC by requesting an updated official species list for their project.

The BLM continues to review the available climate science in connection with its statutory responsibilities, including under NEPA, and has found that despite advances in climate science, global climate models are unable to forecast local or regional effects on resources as a result of specific emissions (IPCC 2013). Any contribution to global climate processes from the issuance of leases is simply too remote, speculative, and undetectable to trigger ESA Section 7 consultation, given accumulated and persisting GHGs already in the atmosphere, the annual volume of GHG emissions that will occur globally regardless of additional lease issuance, and projected continued climate change. See, for example, the Annual GHG Report finding that, "[u]nlike other common air pollutants, the ecological impacts that are attributable to the GHGs are not the result of localized or even regional emissions but are entirely dependent on the collective behavior and emissions of the world's societies"; and noting "the lack of climate analysis tools and techniques that lend themselves to describing the physical climate or earth system responses, such as changes to sea level, average surface temperatures, or regional precipitation rates, that could be attributable to emissions associated with any single [land management] action or decision" (BLM 2023c:16, 85 respectively); see also Threatened Species Status for Emperor Penguin With Section 4(d) Rule, *Federal Register* 87:64700–64704, which states "based on the best scientific data available we are unable to draw a causal link between the effects of specific GHG emissions and take of the emperor penguin in order to promulgate more specific regulations under [ESA Section] 4(d)." *Federal Register* 87:64704.

4.2 TRIBAL CONSULTATION

Tribal consultation for the BLM is guided by a variety of laws, Executive Orders and Memoranda, as well as case law. Laws include the NHPA and subsequent amendments; Public Law (PL) 89-665, October 15, 1966; the Archaeological Resources Protection Act of 1979, PL 96-95, 16 U.S.C. § 470aa-mm, October 31, 1979; the American Indian Religious Freedom Act of 1978, PL 95-341, U.S.C. §§ 1996 and 1996a, August 11, 1978; NEPA, PL 91-190, 42 U.S.C. §§ 4321-4347, January 1, 1970; the Native American Graves Protection and Repatriation Act of 1990, PL 101-601, November 16, 1990; and FLPMA, PL 94-579, October 21, 1976. Executive orders and memoranda include a 1994 Memorandum on Government-to-Government Relations with Native American Tribal Governments (*Federal Register* 59:85, May 4, 1994), Executive Order 13007 on Accommodation of Sacred Sites (*Federal Register* 61:104, May 29, 1996), and Executive Order 12898 on Environmental Justice (*Federal Register* 59:32, February 16, 1994).

Tribal consultation for the leasing actions is done on a government-to-government basis. The FFO initiated government-to-government consultation for the March 2019 Competitive Oil and Gas Lease Sale under NEPA and NHPA on October 12, 2018 with letters mailed to the following pueblos, tribes, and chapters (Table 4.1).

Table 4.1. Pueblos, Tribes, and Chapters Sent Consultation Requests from the BLM FFO, March 2019 Sale

Pueblo of Acoma	Navajo Nation (NN) NN Chapters: Becenti Chapter Counselor Chapter Huerfano Chapter Lake Valley Chapter Pueblo Pintado Chapter
Pueblo of Cochiti	
Hopi Tribe	
Pueblo of Isleta	
Pueblo of Jemez	
Jicarilla Apache Nation	

Kewa Pueblo	Nageezi Chapter House
Pueblo of Laguna	Ojo Encino Chapter
Pueblo of Nambe	Torreon/Star Lake Chapter
Ohkay Owingeh Pueblo	White Rock Chapter
Pueblo of Picuris	Whitehorse Lake Chapter
Pueblo of Pojoaque	All Pueblo Council of Governors
Pueblo of San Felipe	Eight Northern Indian Pueblos Council
Pueblo of San Ildefonso	Five Sandoval Indian Pueblos
Pueblo of Sandia	Ten Southern Pueblo Governors Council
Pueblo of Santa Ana	
Pueblo of Santa Clara	
Southern Ute Tribe	
Pueblo of Taos	
Pueblo of Tesuque	
Ute Mountain Ute Tribe	
Pueblo of Zia	
Pueblo of Zuni	

The BLM received correspondence back from Acoma, Hopi, San Felipe, Isleta, Ojo Encino, NNHHPD, Zuni, and Archaeology Southwest. The Pueblo of Acoma THPO requested additional maps. Additionally, they requested a field trip to parcels 37, 38, and 39. Hopi requested to consult and requested a copy of the literature review once completed. San Felipe requested further consultation. Isleta requested to be consulting party. Ojo Encino requested another copy of the Literature Review as it was misfiled. NNHHPD staff requested digital copies of Lit Review as first copy went to the THPO only. The Literature Review was sent to the parties that requested it on February 15, 2019. Zuni THPO requested to be consulting party verbally on Feb 20, 2019. Archaeology SW requested an emailed copy of the Literature Review be sent to a specific entity. Since the time of the sale, the BLM conducted additional outreach to the Pueblo of Acoma. This outreach was conducted via meetings with the Pueblo of Acoma on December 20, 2023, and March 25, 2024.

Tribal consultation for the leasing actions is done on a government-to-government basis. The FFO initiated government-to-government consultation for the June 2019 Competitive Oil and Gas Lease Sale under NEPA and NHPA on January 25, 2019 with letters mailed to the following pueblos, tribes, and chapters (Table 4.2).

Table 4.2. Pueblos, Tribes, and Chapters Sent Consultation Requests from the BLM FFO, June 2019 Sale

Pueblo of Acoma	Navajo Nation (NN)
Pueblo of Cochiti	NN Chapters:
Hopi Tribe	Becenti Chapter
Pueblo of Isleta	Counselor Chapter
Pueblo of Jemez	Huerfano Chapter
Jicarilla Apache Nation	Lake Valley Chapter
	Pueblo Pintado Chapter

Kewa Pueblo	Nageezi Chapter House
Pueblo of Laguna	Ojo Encino Chapter
Pueblo of Nambe	Torreon/Star Lake Chapter
Ohkay Owingeh Pueblo	White Rock Chapter
Pueblo of Picuris	Whitehorse Lake Chapter
Pueblo of Pojoaque	All Pueblo Council of Governors
Pueblo of San Felipe	Eight Northern Indian Pueblos Council
Pueblo of San Ildefonso	Five Sandoval Indian Pueblos
Pueblo of Sandia	Ten Southern Pueblo Governors Council
Pueblo of Santa Ana	
Pueblo of Santa Clara	
Southern Ute Tribe	
Pueblo of Taos	
Pueblo of Tesuque	
Ute Mountain Ute Tribe	
Pueblo of Zia	
Pueblo of Zuni	

The BLM received correspondence back from Navajo Nation, Acoma, Zuni, Southern Ute, Hopi, and Santa Clara Pueblo. Navajo Nation stated that they concurred with the APE. Acoma, Zuni, Southern Ute, Santa Clara, and Hopi asked to be consulting parties. Meetings and follow-up discussions were held with Acoma, Zuni, Southern Ute and Santa Clara. Hopi notified the BLM that they deferred to the Navajo Nation. The literature review was sent to NM SHPO, NN THPO and consulting parties who had requested it on April 2, 2019. Since the time of the sale, the BLM conducted additional outreach to the Pueblo of Acoma. This outreach was conducted via meetings with the Pueblo of Acoma on December 20, 2023, and March 25, 2024.

Tribal consultation is ongoing, and the BLM FFO will remain available to engage with tribes and pueblos and respond to any consultation requests. If the nominated parcels are leased, future potential development would go through separate NEPA and NHPA processes as directed by regulations and current policy.

4.3 STATE HISTORIC PRESERVATION OFFICE AND TRIBAL HISTORIC PRESERVATION OFFICE CONSULTATION

Section 106 of the NHPA and its implementing regulations in 36 C.F.R. § 800 require federal agencies to consider what effect their licensing, permitting, funding, or otherwise authorizing an undertaking, such as an APD or right-of-way, may have on properties listed in or eligible for listing in the National Register of Historic Places. The regulation at 36 C.F.R. § 800.16 gives specific definitions for key cultural resource management concepts such as undertakings, effects, and APEs.

In consultation with the SHPO and the Navajo Nation Tribal Historic Preservation Office, the BLM FFO determined there would be *no adverse effect* on historic properties as a result of the undertaking. The use of 36 C.F.R. § 800 regulations for this undertaking is appropriate because the lease sale itself does not

directly authorize surface disturbance. Rather, leaseholders are granted future right of development to the leased mineral estate that is subject to site-specific analysis under NEPA and Section 106 of the NHPA at the stage of lease development. Such lease development activities are considered undertakings separate from the lease sale. These undertakings would be subject to additional detailed analysis under NEPA and Section 106. Any significant adverse effects identified for development of the lease parcels would be subject to mitigation or avoidance, as appropriate.

CHAPTER 5. LIST OF PREPARERS

Table 5.1 is a list of individuals that contributed to preparation of this EA.

Table 5.1. List of EA Preparers

Name	Area of Expertise	Organization
Adam Deppe	Air Quality Specialist	BLM NMSO
Catherine Brewster	Natural Resource Specialist	BLM NMSO
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CHAPTER 6. LITERATURE CITED

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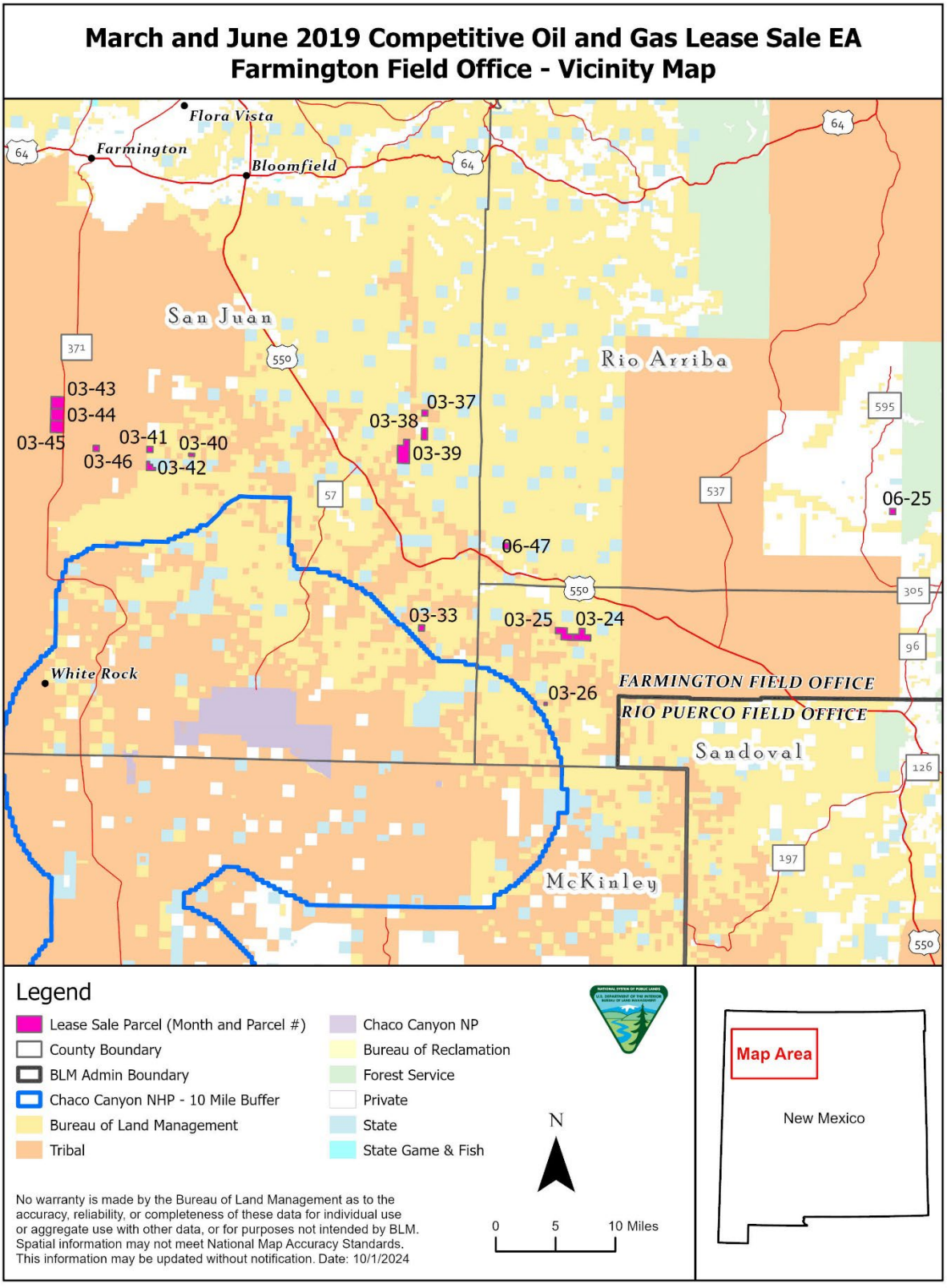
APPENDIX A. MAPS

Figure A.1. Location of the nominated lease parcels analyzed within this EA, within the BLM FFO.



The BLM recognizes a typo in this map and notes the map legend incorrectly lists “Chaco Canyon NHP” instead of “Chaco Culture NHP”.

APPENDIX B. FARMINGTON FIELD OFFICE LEASE STIPULATION AND LEASE NOTICE SUMMARY

Table B.1. BLM and BIA Lease Stipulations and Lease Notices

Stipulation	Description/Purpose*
WO-NHPA	**CULTURAL RESOURCES AND TRIBAL CONSULTATION** 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 Bureau of Land Management (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.
WO-NHPA	**ENDANGERED SPECIES ACT SECTION 7 CONSULTATION** The lease area may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other special status species. BLM may recommend modifications to exploration and development proposals to further its conservation and management objective to avoid BLM-approved activity that will contribute to a need to list such a species or their habitat. BLM may require modifications to or disapprove a proposed activity that is likely to result in jeopardy to the continued existence of a proposed or listed threatened or endangered species or result in the destruction or adverse modification of a designated or proposed critical habitat. BLM will not approve any ground-disturbing activity that may affect any such species or critical habitat until it completes its obligations under applicable requirements of the Endangered Species Act as amended (16 U.S.C. § 1531 *et seq.*), including completion of any required procedure for conference or consultation.
NM-1-LN	**LEASE NOTICE – SPECIAL STATUS PLANT SPECIES** The lease contains potential, suitable, and/or occupied habitat for special status plant species; therefore, special status plant species clearance surveys may be required prior to approving any surface-disturbing activities within or adjacent to BLM Special Status Plant Species' potential, suitable, and occupied habitats. Based on the results of the survey, COAs may be applied to land use authorizations and permits that fall within the area of direct/indirect impacts or affected habitat, as appropriate. Possible mitigation strategies may include, but are not limited to, avoidance/restriction of development, minimizing the area of disturbance, dust abatement measures, deterrents to reduce human disturbance, construction outside of the blooming season, specialized reclamation procedures, long-term monitoring of impacts, general oversight by qualified and independent third-party contractors, nonnative or invasive species monitoring and control in occupied and suitable habitat, or any other on-site habitat protection or improvements.
NM-11-LN	**LEASE NOTICE – SPECIAL CULTURAL RESOURCE** All development activities proposed under the authority of this lease are subject to compliance with Section 106 of the NHPA and Executive Order 13007. The lease area may contain historic properties, traditional cultural properties (TCPs), and/or sacred sites currently unknown to the BLM that were not identified in the Resource Management Plan or during the lease parcel review process. Depending on the nature of the lease developments being proposed and the cultural resources potentially affected, compliance with Section 106 of the NHPA and Executive Order 13007 could require intensive cultural resource inventories, Native American consultation, and mitigation measures to avoid adverse effects—the costs for which will be borne by the lessee. The BLM may require modifications to or disapprove proposed activities that are likely to adversely affect TCPs or sacred sites for which no mitigation measures are possible. This could result in extended time frames for processing authorizations for development activities, as well as changes in the ways in which developments are implemented.
F-4-TL	**TIMING LIMITATION STIPULATION IMPORTANT SEASONAL WILDLIFE HABITAT** No surface use is allowed during the following time period: December 1 through March 31. In addition, no surface use is allowed during the following time period to accommodate the migration of big game within the Lajara and Regina migration route: November 15 through March 31. This stipulation does not apply to the operation and maintenance of production facilities.

Stipulation	Description/Purpose*
F-8-VRM	**CONTROLLED SURFACE USE – VISUAL RESOURCE MANAGEMENT CLASS IV** Surface occupancy or use is subject to the following special operating constraints: Surface activities in this parcel are subject to Visual Resource Management (VRM) Class IV restrictions as set forth in BLM Manual 8400 – Visual Resource Management. Provide for management activities which require major modification of the existing character of the landscape. Activities may attract attention, may dominate the view, but are still mitigated. This may require additional mitigation methods such as special painting stipulations, site placement, and/or any other measures necessary for VRM Class IV objectives. The need for additional mitigation to meet VRM Class IV will be determined on a case-by-case basis for each proposed well.
F-15-POD	**POD STIPULATION** A plan of development (POD) for the entire lease must be submitted for review and approval, including NEPA analysis, by BLM Authorized Officer, prior to approval of development (APD, Sundry Notices) actions. The POD must indicate planned access to well facilities (roads, pipelines, power lines), and the approximate location of well sites. Should it become necessary to amend the POD, the amendment must be approved prior to the approval of subsequent development action. Deviations from a current POD are not authorized until an amended POD has been approved by BLM.
F-27-LN	**FEDERAL COAL** Federal coal resources exist on this lease. Operations authorized by this lease may be altered or modified by the authorized officer (at the address shown below) in order to conserve and protect the mineral resources and provide for simultaneous operations.
F-39-NSO	**NO SURFACE OCCUPANCY - SPECIAL CULTURAL VALUES AND OR TRADITIONAL CULTURAL PROPERTIES** For protecting known cultural resource values and/or traditional cultural properties in areas not already within ACECs.
F-40-CSU	**CONTROLLED SURFACE USE – PROTECTION OF SPECIAL CULTURAL VALUES and/or TRADITIONAL CULTURAL PROPERTIES** Controlled surface use is allowed. Protection of known cultural resource values and/or traditional cultural properties in areas not already within areas of critical environmental concern.
F-41-LN	**LEASE NOTICE – BIOLOGICAL SURVEY** A biological survey may be required prior to any surface-disturbing activity on BLM-managed lands. Proposed activities may be subject to seasonal closures within sensitive species habitat. Federal land management agencies are mandated to manage special status species so they should not need to be listed under Endangered Species Act (ESA) in the future.
F-46-CSU	**CONTROLLED SURFACE USE – TOPOGRAPHY** Surface-disturbing such as well pad activities and related facilities are prohibited on slopes 15% and greater and/or side hill cuts of more than 3 feet vertical. The maximum grade on collector and arterial roads is 8% (except pitch grades not exceeding 300 feet in length and 10% in grade).

* Stipulation descriptions are summarized for brevity. The full text of all stipulations, including all modifications, waivers, and exceptions, can be found in the Farmington RMP (BLM 2003), as amended (BLM 2014, 2015).

BIA-1	**NAVAJO REGION, BUREAU OF INDIAN AFFAIRS SURFACE MANAGEMENT AGENCY LEASE STIPULATIONS FOR FEDERAL OIL AND GAS LEASE OFFERING** 1. Lessee shall carry on all operations in a good and workmanlike manner in accordance with approved methods and practices. 2. Lessees shall abide by and conform to appropriate provisions of Titles 25, 36, and 43 Code of Federal Regulations, and any and all other applicable regulations and manuals of the Secretary now or hereafter in force relative to surface leasing rights-of-way and as amended, and National Area Environmental Protection guidelines; the National Historic Preservation Act of 1966, as amended, Archaeological Resources Protection act, and American Indian Religious Freedom Act and other applicable laws, 30 BIA, 36 CFR 800 and 43 CFR 7. a. Prior to issuing any cultural clearances, the Lessee shall provide the necessary cultural clearances to the Bureau of Land Management, after consultation with the Navajo Nation Historic Preservation Department, P.O. Box 4950, Window Rock, AZ 86515, and provide copies of all historic preservation related documents associated with an undertaking. The Navajo Nation contracted Under Public Law 93-638 the Navajo Area Archaeology Office. b. Prior to entry upon the land or the disturbance of the surface thereof for drilling or other purposes, lessee shall submit a development plan for surface use to the Area Manager, Farmington Resource Area, Bureau of Land Management, 6251 College Blvd, Suite A, Farmington, NM 87402. An Environmental Analysis will be made by the Bureau of Land Management in consultation with the BIA Navajo Region Office for the purpose of ensuring proper protection of the surface, the natural resources, the environment and existing improvements and for assuring timely reclamation of disturbed lands. Upon completion of said environmental analysis, the Oil and Gas Field Manager shall notify Lessee of the conditions to which the proposed surface disturbing operations will be subject. (Note: Prior to operations beginning; Lessee shall furnish a copy of its development plan and Bureau of Land Management conditions to the BIA. The BIA reserves the right to require site specific archaeological surveys and environmental reviews on tracts selected for development prior to giving concurrence to proposed actions(s). The BIA will consult with the Navajo Nation prior to concurring in such actions.) 3. The Lessee shall not use or permit to be used any part of said leased land for any unlawful conduct or purpose whatsoever. Lessee will not use or permit to be used any part of said leased land for the manufacture, sale, gift, transportation, or storage of intoxicating liquors, beverages or drugs. In the event any representative of Lessee or its contractor or subcontractor, employed in connection with the operations on the lease premises shall be responsible for any of the unlawful acts described in this clause, Bureau of Land Management shall give Lessee information as to such violation(s) with a copy of the notice to BIA and Navajo Nation. Lessee shall immediately take steps to cure the violations, including the termination or transfer of such employee. (25 CFR 162; 18 USC Sections 1151, 1154 and 1156, as amended.) 4. Except as otherwise stated herein, copies of correspondence and notices shall be mailed to the Bureau of Indian Affairs in care of the Regional Director, Navajo Region Office, Attention: Branch of Real Estate Services, Bureau of Indian Affairs, P.O. Box 1060, Gallup, NM 87305-1060; and to the Navajo Nation in care of the President, Navajo Nation, Attention: Navajo Tribal Minerals Department, P.O. Box 1910, Window Rock, AZ 86515. **<u>THE NAVAJO NATION STIPULATIONS</u>** 1. The surface ownership of lands contained in this lease may be all or partly managed by the Navajo Nation. Site specific rights-of-way clearances and/or inventories may be required prior to entry upon the surface for operation of the lease holdings. Prior contact with the Navajo Nation will be required prior to operations beginning. All applicable laws of the Navajo Nation (including tax laws, water codes, requirements of Environmental Protection Administration, etc.) shall be complied with the Lessee. 2. The Navajo Nation requires a copy of complete exploration and development data (drilling logs, seismic data, etc.) obtained by the Lessee on the subject lands will be provided to the Navajo nation at no cost. All materials data will be held confidential as described in 43 CFR 3162.8. 3. Navajo grazing rights to the surface of the lands so leased shall be protected, and the Nation's rights respecting the use of water shall be unimpaired. 4. Lessee shall not obtain water for use in drilling from Indian-owned wells, tanks, springs, or stockwater reservoirs without prior written permission from the Navajo Nation. Lessee shall not drill any water wells for its use without prior written consent of the Navajo Nation and the Regional Director. 5. Lessee shall compensate the Navajo nation and its grazing permittees (if any), for all surface use(s) as well as damages to crops, buildings, and other improvements of surface landowner,

	including loss of grazing lands, occasioned by the Lessee's operations except the Lessee's control. Compensation for surface use shall be negotiated by Lessee and the Navajo Nation and will be based upon the duration of activity on the land. 6. Lessee shall not drill any well within 500 feet of any house, structure, or reservoir of water without the Navajo Nation's written consent. 7. Lessee shall bury all pipelines crossing tillable lands below plow depth unless other arrangements are made with the Navajo Nation. Upon the request of the Navajo Nation or if so required by the Regional Director or his authorized representative, and under the director of the Field Manager, Bureau of Land Management, the Lessee shall condition any well drilled which does not produce oil or gas in paying quantities, but which is capable of producing water satisfactorily for domestic, agricultural, or livestock use by the Navajo Nation. Otherwise, after the expiration or termination of the lease, the Lessee shall remove all pumping equipment installed by Lessee at any well.
BIA-3	**NAVAJO REGION, BUREAU OF INDIAN AFFAIRS SURFACE MANAGEMENT AGENCY LEASE STIPULATIONS FOR FEDERAL OIL AND GAS LEASE OFFERING** The pipeline will be so installed that it will not interfere with the construction and/or development of the area for agricultural purposes and/or operation of same in connection with the Navajo Indian Irrigation Project (NIIP). Any changes or relocations found to be necessary during said construction and/or development will be accomplished at the Company's expense. In addition, the pipeline will be buried to a depth of 48 inches and any permanent metering and production equipment installed at the actual site will conform to "no well and/or production equipment within irrigable fields of the Navajo Indian Irrigation Project will exceed two feet above natural surface elevation and be adequately barricade for safety." Further, if crops are planted prior to accomplishment of the pipeline work, surface damages must be negotiated with Navajo Agricultural Products Industry.

APPENDIX C. LEASING PREFERENCE RATINGS FOR NOMINATED LEASE PARCELS

In accordance with IM 2023-007, *Evaluating Competitive Oil and Gas Lease Sale Parcels for Future Lease Sales* (BLM 2022b), the BLM has evaluated the nominated lease parcels against five criteria to determine each parcel's leasing preference (Table C.1). It should be noted that the parcels considered here will not contribute to Inflation Reduction Act statistics because they were offered for sale in 2019.

Table C.1. Leasing Preference Ratings for Nominated Lease Parcels

Leasing Preference Rating Based on the Following Criteria								
Parcel Information		**Preference Criteria**					**Preference for Leasing[#]**	
Office	**Parcel**	**1 Proximity to Existing Development***	**2 Habitat†**	**3 Cultural Resources‡**	**4 Recreation/ Other Resources§**	**5 High Potential¶**	**High**	**Low**
FFO	NM-201903-024	High	High	Low	High	High		X
FFO	NM-201903-025	High	High	Low	High	High		X
FFO	NM-201903-026	High	High	Low	High	Low		X
FFO	NM-201903-033	High	High	Low	High	High		X
FFO	NM-201903-037	High	High	Low	High	Low		X
FFO	NM-201903-038	High	Low	Low	High	Low		X
FFO	NM-201903-039	High	Low	Low	High	High		X
FFO	NM-201903-040	High	High	High	Low	Low		X
FFO	NM-201903-041	High	High	High	Low	Low		X
FFO	NM-201903-042	High	High	High	Low	Low		X
FFO	NM-201903-043	High	High	Low	High	Low		X
FFO	NM-201903-044	High	High	Low	High	Low		X
FFO	NM-201903-045	High	High	Low	High	Low		X
FFO	NM-201903-046	High	High	Low	High	Low		X
FFO	NM-201906-025	High	Low	Low	High	Low		X
FFO	NM-201906-047	High	Low	Low	High	High		X

*Determinations in this column are made by reviewing aerial imagery for signs of existing oil and gas development within 5 miles of the parcel boundaries.

†Low determinations in this column would indicate the presence of important fish and wildlife habitats or connectivity areas (e.g., suitable habitat for special status species or surface water features). The protections offered through stipulations and COAs would effectively avoid and minimize associated habitat and species concerns; therefore, the BLM proposes moving these parcels forward for leasing.

‡ Low determinations in this column would indicate the presence of known cultural resources within the parcel, such as historic properties, sacred sites, and other high value cultural resources (see AIB-17 and AIB-18). The nominated lease parcels assessed within this EA have been assigned the National WO-NHPA Lease Stipulation, which requires additional cultural resources analyses pursuant to Section 106 of the NHPA, to include identification, effects assessment, consultation, and if necessary, resolution of adverse effects, prior to the authorization of any ground-disturbing activities associated with the oil and gas lease. Additionally, the nominated lease parcels assessed within this EA have also been assigned Lease Notice NM-11-LN, which requires compliance with Section 106 of the NHPA and Executive Order 13007 (see Appendix B). Some of the parcels have additional stipulations for cultural resources. Because of the protections offered through stipulations and COAs, the BLM proposes moving parcels forward for leasing.

§ Low determinations in this column would indicate the presence of recreation or other important uses or resources which are incompatible with oil and gas development.

¶ Determinations in this column are made using the RFD scenario and consider site-specific changes that may have occurred since the RMP was signed.

#In accordance with the BLM's *Guidelines for Evaluating Lease Parcels in Expressions of Interest and Recording Preferential Status in NFLSS* (Attachment 1 to IM 2023-007 [BLM 2022b]), if a parcel receives a low preference value for any single criterion, it will receive an overall low preference

value regardless of the other criteria. If none of the criterion result in a low preference value, then the parcel would receive a high preference value for leasing. Other considerations that would warrant a different preference value can also be used but should be justified in the evaluation sheet.

APPENDIX D. SUMMARY OF THE TYPICAL PHASES OF OIL AND GAS DEVELOPMENT

INTRODUCTION

The phases of oil and gas development include construction, drilling operations, completion operations, hydraulic fracturing, and production. During the construction activity phase, the area is cleared of vegetation and the pad is constructed. Throughout the drilling operation phase, equipment is moved on-site and used to install the drill rig and other associated infrastructure. At this stage, the well is drilled. Well completion follows well drilling. Well completion includes setting the casing to depth, cementing the casing,[29] and perforating the casing in target zones. If a well is going to be drilled directionally,[30] horizontally,[31] or vertically[32] this phase may be followed by hydraulic fracturing, which involves pumping fracturing fluid into a formation at a calculated, predetermined rate and pressure to generate fractures or cracks in the target formation. The production phase begins when the well starts producing. The well abandonment and reclamation phases occur after the productive life of the well has concluded. Well abandonment and reclamation involve plugging wells and reclaiming the surface according to BLM guidelines and requirements.

Construction Activities

First, new construction areas need to be cleared of all vegetation. Clearing of the proposed well pad and access road are typically limited to the smallest area possible to provide safe and efficient work areas for all phases of construction. All clearing activities are accomplished by cutting, mowing, and/or grading vegetation, as necessary. Cut vegetation may be mulched and spread on-site or hauled to a commercial waste disposal facility.

Next, heavy equipment, including but not limited to bulldozers, graders, front-end loaders, and/or track hoes, are used to construct the pad, along with other features, as needed for development. Other features may include, but are not limited to, an access road, reserve pit, pipeline, and/or fracturing pond. Cut and fills may be required to level the pad or road surfaces. Reserve pits, if authorized, are lined using an impermeable liner or other lining mechanism (i.e., bentonite or clay) to prevent fluids from leaching into the soil. Access roads may have cattle guards, gates, drainage control, or pull-outs installed, among a host of other features that may be necessary based on the site-specific situation. Long-term surface

[29] According to BLM regulations from 43 C.F.R. § 3172, casing and cementing programs are conducted to protect and/or isolate all usable water zones, lost circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. The casing setting depth is calculated to position the casing seat opposite a competent formation that will contain the maximum pressure to which it will be exposed during normal drilling operations. Determination of casing setting depth is based on all relevant factors, including presence/absence of hydrocarbons; fracture gradients; usable water zones; formation pressures; lost circulation zones; other minerals; or other unusual characteristics. Any isolating medium other than cement shall receive approval prior to use. The deepest casing may not be cemented and may remain open hole depending on the type of formation it is located in.

[30] Vertical drilling is the process of drilling a well from the surface vertically to a subsurface location where the target oil or gas reservoir is located (U.S. Department of Energy 2015).

[31] Horizontal drilling is the process of drilling a well from the surface to a subsurface location just above the target oil or gas reservoir called the "kickoff point," then deviating the well bore from the vertical plane around a curve to intersect the reservoir at the "entry point" with a near-horizontal inclination, and remaining within the reservoir until the desired bottom hole location is reached (North Dakota Department of Mineral Resources 2008).

[32] Directional drilling is the process of controlling the direction and deviation of drilling a well from the surface to a subsurface location without disturbing the land directly above the target oil or gas reservoir (U.S. Department of Energy 2015).

disturbances such as pads and roads are typically surfaced with a layer of crushed rock. Areas not needed for long-term development are reclaimed by recontouring the surface and re-establishing vegetation.

A pipeline, if needed, is laid within a right-of-way that is first cleared of vegetation. A backhoe, or similar piece of equipment, digs a trench to a depth at least 36 inches below ground surface. After the trench is dug, the pipeline is assembled by welding pieces of pipe together to fit the contour of the pipeline's path. Once inspected, the pipe can be lowered into the trench and covered with stockpiled subsoil originally removed from the trench. Each pipeline undergoes hydrostatic testing prior to natural gas being pumped through the pipeline. This ensures the pipeline is strong enough and absent from any leaks. Table D.1 includes some common wastes (hazardous and nonhazardous) that are produced during construction.

Drilling Operations

When construction of the well pad is complete, the drilling rig and associated equipment are moved on site and erected. Usually, a conventional rotary drill rig is used. The drill rig must be capable of withstanding all the anticipated conditions that may be encountered while drilling. Wells may be drilled directionally, horizontally, or vertically based on the target formation. The depth of the well is entirely dependent on the target formation depth and may be several hundred feet deep to over 20,000 feet deep.

When a conventional reserve pit[33] system is used, drilling fluid or mud is circulated through the drill pipe to the bottom of the hole, through the bit, up the bore of the well, and finally to the surface. When drilling mud emerges from the hole, it enters the reserve pit where it remains until all fluids are evaporated and the solids can be buried.

A closed-loop system operates in a similar fashion except that when the drilling mud emerges from the hole, it passes through equipment used to screen and remove drill cuttings (rock chips) and sand-sized solids rather than going into a pit. When the solids have been removed, the drilling mud is placed into holding tanks, and from the tank, used again.

In either situation, the drilling mud is maintained at a specific weight and viscosity to cool the bit, seal off any porous zones (thereby protecting aquifers and preventing damage to producing zone productivity), control subsurface pressure, lubricate the drill string, clean the bottom of the hole, and bring the drill cuttings to the surface. Water-based or oil-based muds can be used. This choice is dependent on the site-specific conditions.

Once a well has been drilled, completion operations begin. Well completion involves setting casing to depth and perforating the casing in target zones.

Wells are often treated during completion to improve the recovery of hydrocarbons by increasing the rate and volume of hydrocarbons moving from the natural oil and gas reservoir into the wellbore. These processes are known as well-stimulation treatments, which create new fluid passageways in the producing formation or remove blockages within existing passageways. They include fracturing, acidizing, and other mechanical and chemical treatments often used in combination. The results from different treatments are additive and complement each other.

Hydraulic Fracturing

Hydraulic fracturing is a formation stimulation practice used to create additional permeability in a producing formation, thus allowing oil and/or gas to flow more readily toward and into the wellbore.

[33] A conventional reserve pit is a lined earthen pit excavated adjacent to a well pad and is commonly used for the disposal of drilling muds and fluids in gas or oil fields (U.S. Fish and Wildlife Service 2009).

Hydraulic fracturing can be used to overcome natural barriers, such as naturally low permeability or reduced permeability resulting from near wellbore damage to the flow of fluids (gas or water) to the wellbore (Groundwater Protection Council 2017). The process has been a method for additional oil and gas recovery since the 1900s; however, with the advancement of technology, in both hydraulic fracturing and horizontal drilling, it is more commonly used than previous hydraulic fracturing and horizontal drilling technologies.

Hydraulic fracturing uses high-pressure pumps to pump fracturing fluid into a formation at a calculated, predetermined rate and pressure to generate fractures or cracks in the target formation. For shale developments (within Mancos shale geologic formations, for example), fracture fluids are primarily water-based fluids mixed with additives that help the water to carry "proppants" into the fractures. Proppants, which may be made up of sand, walnut hulls, or other small particles, are needed to "prop" open the fractures once the pumping of fluids has stopped. Once the fracture has initiated, additional fluids are pumped into the wellbore to continue the development of the fracture and to carry the proppant deeper into the formation. The additional fluids are needed to maintain the downhole pressure necessary to accommodate the increasing length of opened fracture in the formation.

Hydraulic fracturing increases the flow rate and volume of reservoir fluids that move from the producing formation into the wellbore. The fracturing fluid is typically more than 99% water and sand, with small amounts of readily available chemical additives used to control the chemical and mechanical properties of the water and sand mixture. Because the fluid is composed mostly of water, large volumes of water are usually needed to perform hydraulic fracturing (estimates of water usage for hydraulic fracturing are provided in the BLM New Mexico Water Support Document [BLM 2023b]). However, in some cases, water is recycled or produced water is used.

The predominant fluids currently being used for fracture treatments in the shale gas plays are water-based fracturing fluids mixed with friction-reducing additives, also known as slickwater (Groundwater Protection Council 2017). The number of chemical additives used in a typical fracture treatment varies depending on the conditions of the specific well that is to be fractured. A typical fracture treatment uses very low concentrations of between three and 12 additive chemicals, depending on the characteristics of the water and the shale formation being fractured. Each component serves a specific, engineered purpose, from limiting the growth of bacteria to preventing corrosion of the well casing. The makeup of fracturing fluid varies from one geologic basin or formation to another. Because the makeup of each fracturing fluid varies to meet the specific needs of each area, there is no one-size-fits-all formula for the volumes for each additive. In classifying fracture fluids and their additives, it is important to realize that service companies that provide these additives have developed a number of compounds with similar functional properties to be used for the same purpose in different well environments. The difference between additive formulations may be as small as a change in concentration of a specific compound (Groundwater Protection Council 2017).

Before operators or service companies perform a hydraulic fracturing treatment, a series of tests are performed. These tests are designed to ensure that the well, including casing and cement, well equipment, and fracturing equipment, are in proper working order and would safely withstand the application of the fracture treatment pressures and pump flow rates.

Hydraulic fracturing of horizontal shale gas wells is most commonly performed in stages. Lateral lengths in horizontal wells for development may range from 1,000 feet to more than 5,000 feet. Depending on the lengths of the laterals, treatment of wells may be performed by isolating smaller portions of the lateral. The fracturing of each portion of the lateral wellbore is called a stage. Stages are fractured sequentially beginning with the section at the farthest end of the wellbore, moving up hole as each stage of the treatment is completed until the entire lateral well has been stimulated. During drilling, the BLM is on

location during the casing and cementing of the surface casing, which is often the string of casing that protects groundwater, along with other critical casing and cementing intervals. Before hydraulic fracturing takes place, all surface casing and some deeper, intermediate zones are required to be cemented from the bottom of the cased hole to the surface. The cemented well is pressure tested to ensure there are no leaks, and in some cases, a cement bond log is run to ensure the cement has bonded to the casing and the formation. If the fracturing of the well is considered to be a "non-routine" fracturing job for the area, the BLM would always be on-site during those operations as well as when abnormal conditions develop during the drilling or completion of a well.

Some soils and geologic formations contain low levels of radioactive material. This NORM emits low levels of radiation, to which everyone is exposed on a daily basis. When NORM is associated with oil and natural gas production, it begins as small amounts of uranium and thorium within the rock. These elements, along with some of their decay elements, notably radium-226 and radium-228, can be brought to the surface in drill cuttings and produced water. Radon-222, a gaseous decay element of radium, can come to the surface along with the shale gas. When NORM is brought to the surface, it remains in the rock pieces of the drill cuttings, remains in solution with produced water, or, under certain conditions, precipitates out in scales or sludges. The radiation is weak and cannot penetrate dense materials such as the steel used in pipes and tanks. Testing is required prior to disposal of pipes, tanks, and pipe deposits according to NMAC 19.15.35.8. Radiation levels used to define "regulated NORM" in oil-field soils, equipment, sludges, or other materials related to oil field operations or processes are defined at NMAC 20.3.14.1403. Disposal of NORM (including in produced water) is regulated per NMAC 19.15.35.9 through 19.15.35.14 and the New Mexico environmental improvement board rule, NMAC 20.3.14. Per NMAC 20.3.14.1403, produced water is exempt from the requirements of these regulations if it is reinjected into a Class I or Class II UIC well permitted by the NMOCD and/or stored or disposed of in a double, synthetically lined surface impoundment permitted by the NMOCD.

Production Operations

Production equipment used during the life of the well may include a three-phase separator-dehydrator, flowlines, a meter run, tanks for condensate, produced oil and water, and heater treater. A pumpjack may be required if the back pressure of the well is too high. Production facilities are arranged to facilitate safety and maximize reclamation opportunities. All permanent aboveground structures not subject to safety considerations are painted a standard BLM environmental color or as landowner specified.

Workovers may be performed multiple times over the life of the well. Because oil and gas production usually declines over the years, operators perform workover operations, which involve cleaning, repairing, and maintaining the well for the purposes of increasing or restoring production.

Abandonment and Reclamation

Well abandonment (whether dry hole or depleted producer) and reclamation of location, access roads, and other facilities require BLM approval. After approval, wellbores are plugged with cement as necessary to prevent fluid or pressure mitigation and to protect and isolate mineral and water resources. Wellheads are removed, and both the surface casing and the production casing are cut off below ground in compliance with federal and state regulations. The well pad, reserve pit, and access roads are reclaimed according to BLM guidelines. This may include backfilling the pit, recontouring the surface to blend with natural surroundings, and redistributing topsoil. All surfaces are then reseeded according to BLM and state requirements specified in the APD approval.

Common Wastes

Table D.1 includes some of the common wastes (hazardous and nonhazardous) that are produced during oil and gas development.

Table D.1. Common Wastes Produced During Oil and Gas Development

Phase	Waste	
Construction, well drilling and completion (including hydraulic fracturing)	Domestic wastes (e.g., food scraps, paper)	
	Excess construction materials	Woody debris
	Used lubricating oils	Paints
	Solvents	Sewage
	Drilling muds, including additives (i.e., chromate and barite) and cuttings. Well drilling, completion, workover, and stimulation fluids (i.e., oil derivatives such as polycyclic aromatic hydrocarbons, spilled chemicals, suspended and dissolved solids, phenols, cadmium, chromium, copper, lead, mercury, nickel)	
	Equipment, power unit and transport maintenance wastes (i.e., batteries; used filters, lubricants, oil, tires, hoses, hydraulic fluids; paints; solvents)	
	Fuel and chemical storage drums and containers	
	Cementing wastes	Rig wash
	Production testing wastes	Excess drilling chemicals
	Excess construction materials	Processed water
	Scrap metal	Contaminated soil including hazardous and nonhazardous materials (potential)
	Sewage	Domestic wastes
Production	Power unit and transport maintenance wastes (i.e., batteries; used filters, lubricants, filters, tires, hoses, coolants, antifreeze; paints; solvents; used parts)	
	Discharged produced water	
	Production chemicals	
	Workover wastes (e.g., brines)	
Abandonment/ Reclamation	Construction materials	
	Decommissioned equipment	
	Contaminated soil (potential)	
	Equipment or wastes that could contain hazardous and nonhazardous materials	

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APPENDIX E. ENVIRONMENTAL JUSTICE MAPS AND DATA

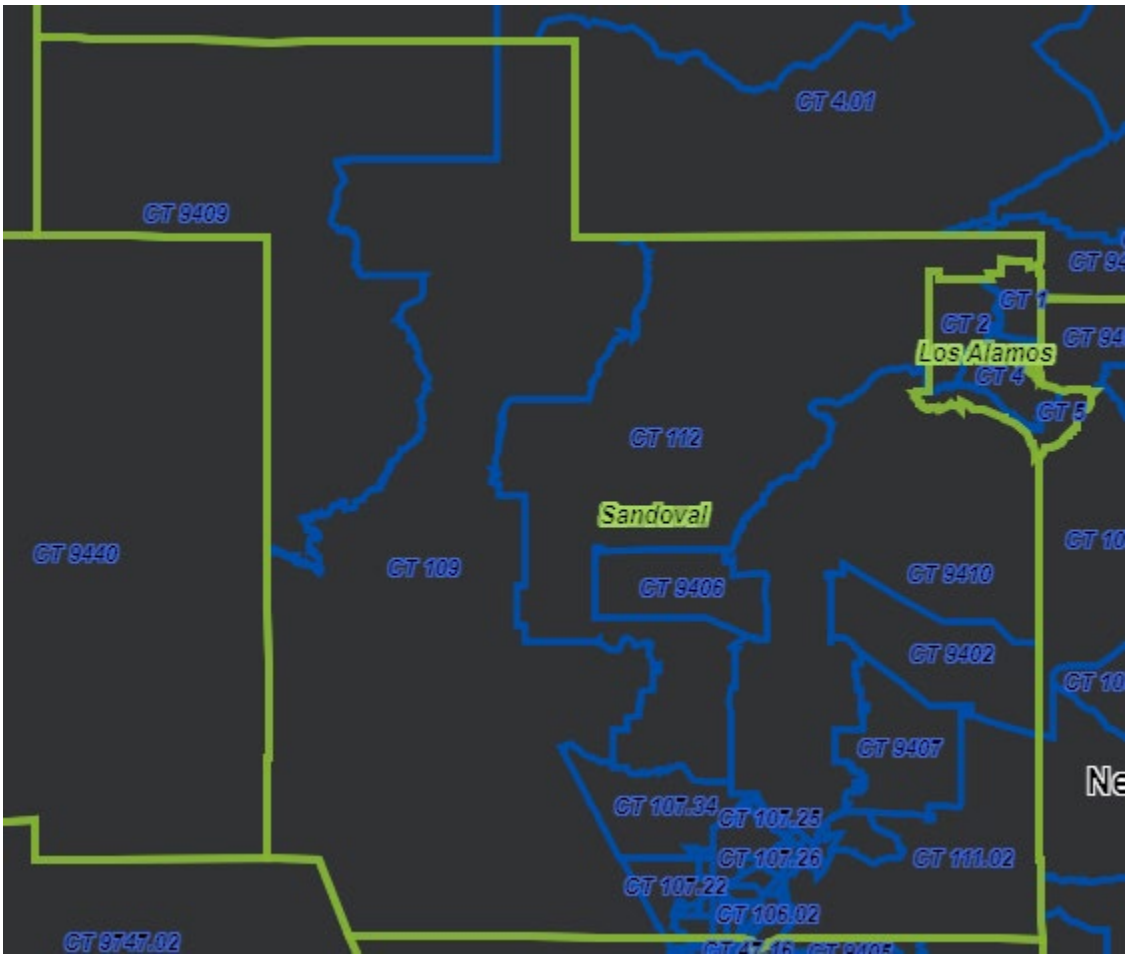
Figure E.1a. Environmental justice analysis area and CT within San Juan County.

Source – BLM 2023g.

Figure E.2b. Environmental justice analysis area and places within San Juan County.

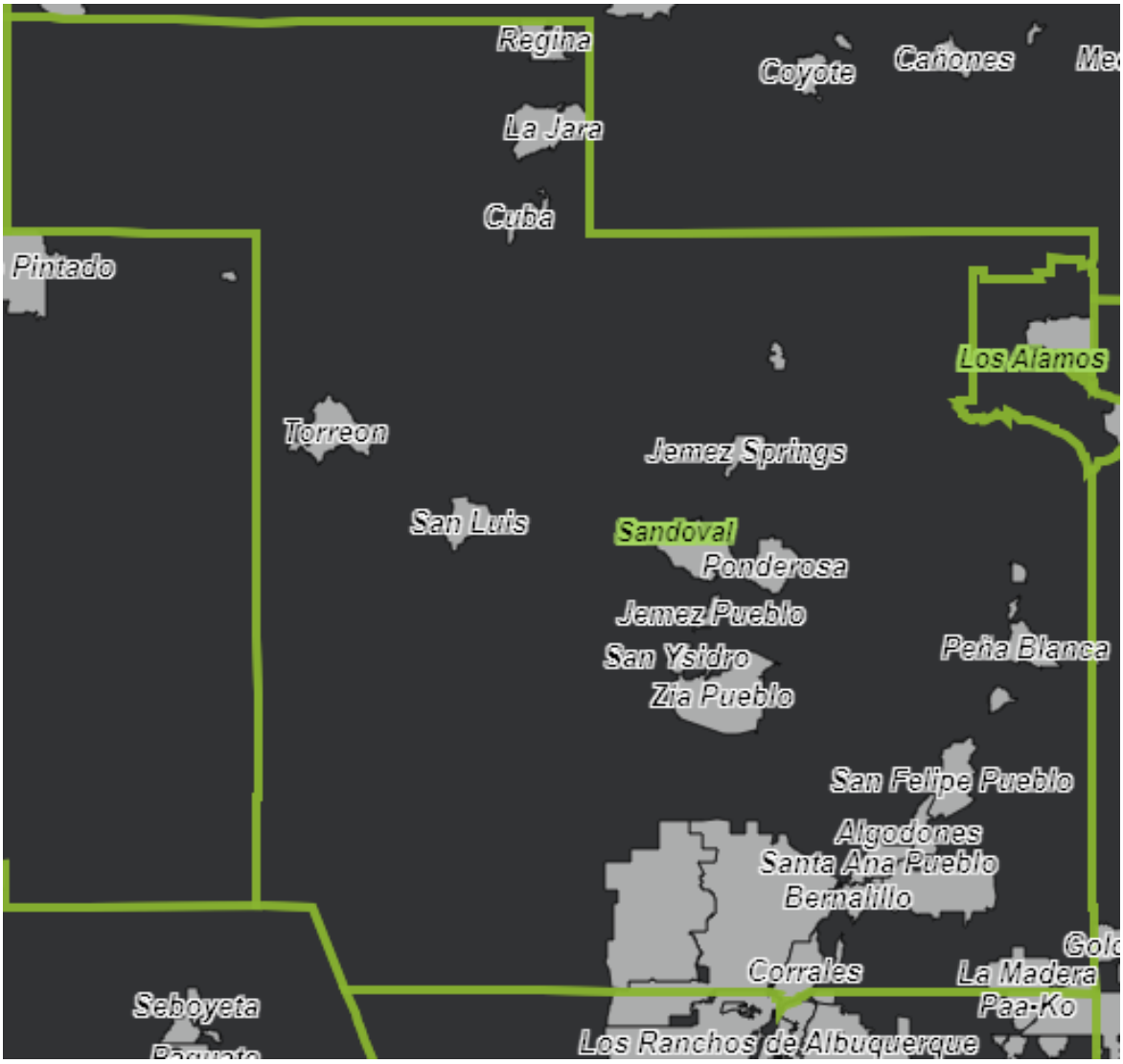
Source – BLM 2023g.

Figure E.2a. Environmental justice analysis area and CT within Sandoval County.



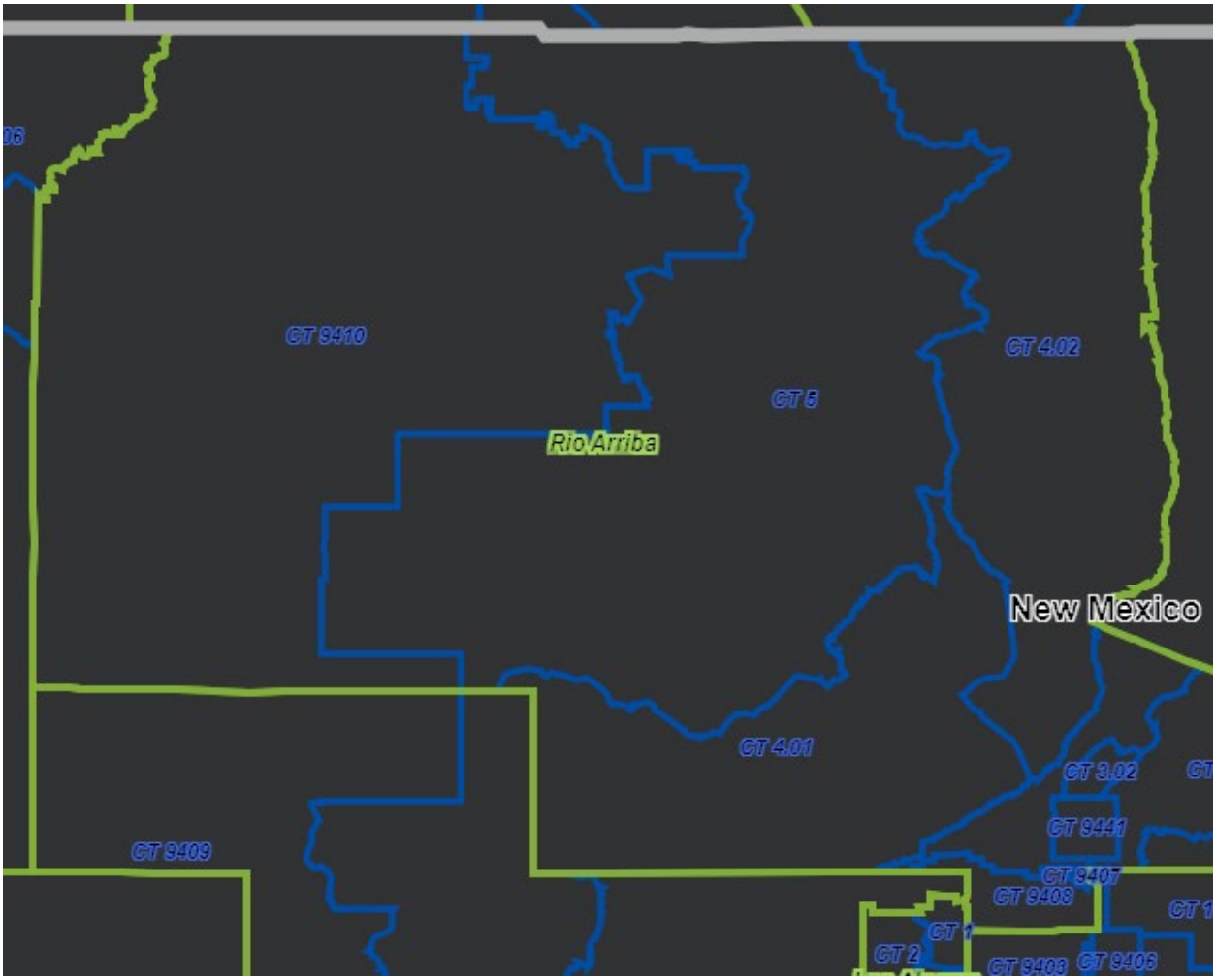
Source – BLM 2023g.

Figure E.2b. Environmental justice analysis area and places within Sandoval County.



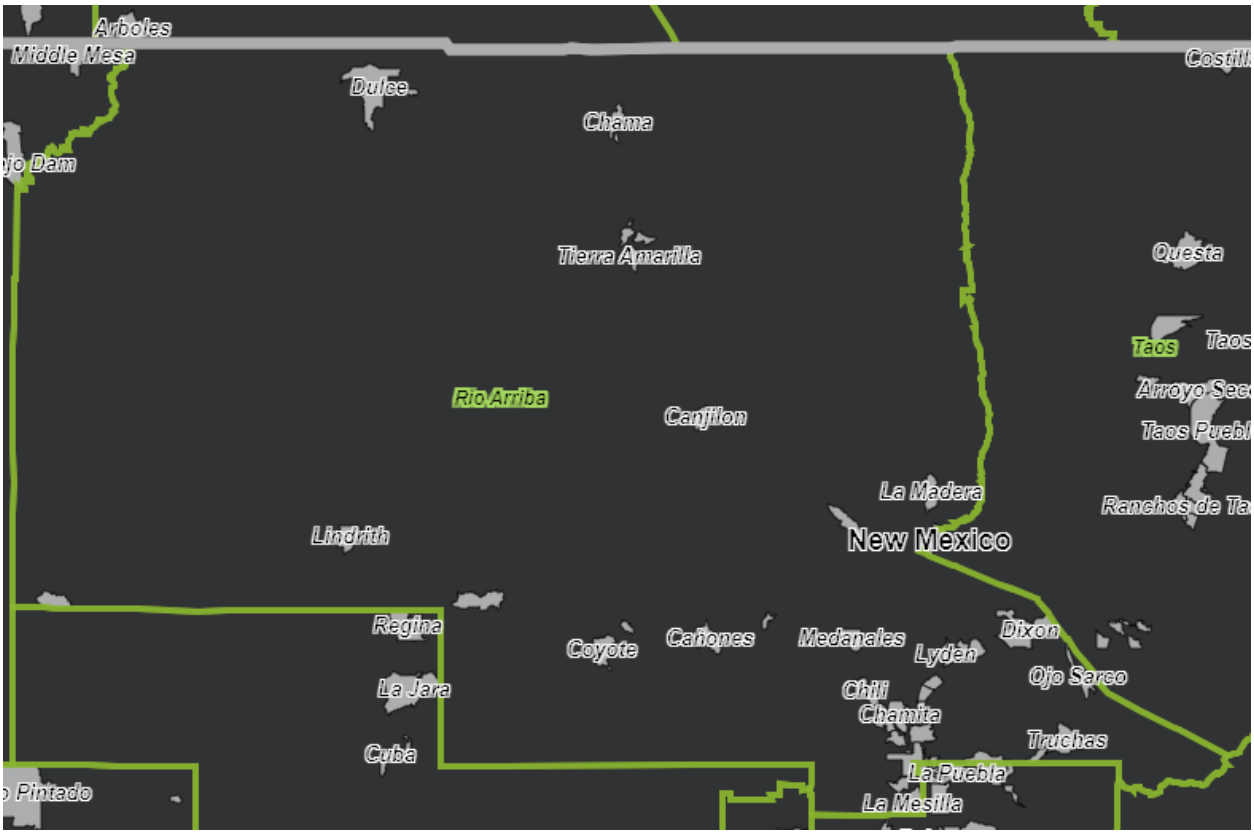
Source – BLM 2023g.

Figure E.3a. Environmental justice analysis area and CT within Rio Arriba County.



Source – BLM 2023g.

Figure E.3b. Environmental justice analysis area and places within Rio Arriba County.



Source – BLM 2023g.

Table E.1. Low-Income and Minority Communities of Concern Applicable to the Area of Analysis

Analysis Unit	Total Population						
United States[¶]	329,725,481						
New Mexico	2,109,366						
		Not Hispanic or Latino (white alone) population 2021	Minority population (%) in 2021	Median household incomes ($) in 2021	Population with income below 200% of poverty level in 2021	Population for whom poverty status is determined in 2021	Low-income population (%) in 2021
COUNTIES							
Rio Arriba County	40,347	4,767	88.2%	46,994	16,543	40,137	41.2%
Sandoval County	147,327	61,808	58.0%	68,947	38,166	146,075	26.1%
San Juan County	122,912	44,936	63.4%	47,485	58,617	121,148	48.4%
CENSUS TRACTS							
CT 1, Rio Arriba County	3,161	304	90.4%	51,795	1,130	3,161	35.7%
CT 2, Rio Arriba County	3,036	378	87.5%	38,802	966	3,036	31.8%
CT 3.01, Rio Arriba County	3,600	266	92.6%	55,260	1,200	3,600	33.3%
CT 3.02, Rio Arriba County	2,526	117	95.4%	53,200	531	2,526	21.0%
CT 4.01, Rio Arriba County	1,912	287	85.0%	33,490	769	1,912	40.2%
CT 4.02, Rio Arriba County	2,250	121	94.6%	39,273	1,106	2,250	49.2%
CT 5, Rio Arriba County	3,613	914	74.7%	47,072	1,465	3,564	41.1%
CT 9407, Rio Arriba County	3,103	647	79.1%	36,250	1,560	3,057	51.0%
CT 9408, Rio Arriba County	5,519	954	82.7%	64,239	1,827	5,514	33.1%
CT 9410, Rio Arriba County	4,766	237	95.0%	40,461	2,789	4,682	59.6%
CT 9441, Rio Arriba County	6,861	542	92.1%	42,314	3,200	6,835	46.8%
CT 105.03, Sandoval County	3,499	928	73.5%	68,229	1,202	3,499	34.4%
CT 106.01, Sandoval County,	4,726	3,264	30.9%	127,156	523	4,709	11.1%
CT 106.02, Sandoval County	3,762	2,544	32.4%	83,657	663	3,762	17.6%
CT 107.02, Sandoval County	7,928	4,211	46.9%	86,625	854	7,620	11.2%

Analysis Unit	Total Population						
CT 107.05, Sandoval County	5,503	3,043	44.7%	77,308	1,030	5,503	18.7%
CT 107.12, Sandoval County	5,536	2,348	57.6%	57,780	1,478	5,536	26.7%
CT 107.13, Sandoval County	5,349	2,319	56.6%	48,008	1,689	5,334	31.7%
CT 107.14, Sandoval County	4,949	2,533	48.8%	62,468	1,258	4,927	25.5%
CT 107.15, Sandoval County	3,890	2,132	45.2%	53,810	917	3,871	23.7%
CT 107.19, Sandoval County	3,859	1,645	57.4%	78,919	546	3,859	14.1%
CT 107.21, Sandoval County	4,510	1,892	58.0%	60,063	1,232	4,490	27.4%
CT 107.22, Sandoval County,	6,384	2,851	55.3%	72,024	1,579	6,248	25.3%
CT 107.24, Sandoval County	2,757	932	66.2%	82,536	676	2,757	24.5%
CT 107.25, Sandoval County	8,165	3,369	58.7%	76,589	1,374	8,165	16.8%
CT 107.26, Sandoval County	6,233	2,940	52.8%	101,672	391	6,233	6.3%
CT 107.27, Sandoval County	2,822	1,295	54.1%	71,442	402	2,822	14.2%
CT 107.28, Sandoval County	2,204	1,335	39.4%	91,698	191	2,204	8.7%
CT 107.29, Sandoval County	7,931	3,532	55.5%	86,141	1,576	7,711	20.4%
CT 107.30, Sandoval County	1,869	732	60.8%	101,523	456	1,869	24.4%
CT 107.31, Sandoval County	7,958	3,690	53.6%	77,757	950	7,894	12.0%
CT 107.32, Sandoval County	6,354	2,862	55.0%	44,554	2,192	6,081	36.0%
CT 107.33, Sandoval County	5,551	2,509	54.8%	71,646	1,802	5,540	32.5%
CT 107.34, Sandoval County	6,132	3,008	50.9%	82,513	1,713	6,132	27.9%
CT 109, Sandoval County	2,195	279	87.3%	34,570	1,240	2,122	58.4%
CT 111.01, Sandoval County	3,146	1,669	46.9%	86,016	776	3,146	24.7%
CT 111.02, Sandoval County	3,184	1,665	47.7%	80,712	854	3,184	26.8%
CT 112, Sandoval	2,932	821	72.0%	82,621	1,146	2,930	39.1%

Analysis Unit	Total Population						
CT 9402, Sandoval County	3,069	107	96.5%	41,141	1,388	3,048	45.5%
CT 9405, Sandoval County	4,246	605	85.8%	40,403	2,266	4,236	53.5%
CT 9406, Sandoval County	2,042	5	99.8%	49,700	1,013	2,027	50.0%
CT 9407, Sandoval County	3,590	219	93.9%	42,500	1,675	3,586	46.7%
CT 9409, Sandoval County	3,398	164	95.2%	16,996	2,510	3,376	74.3%
CT 9410, Sandoval County	1,654	360	78.2%	46,324	604	1,654	36.5%
CT 9800, Sandoval County	0	0	n/a	n/a	0	0	n/a
CT 1, San Juan County	4,784	1,851	61.3%	38,456	2,197	4,722	46.5%
CT 2.01, San Juan San Juan County	3,787	2,428	35.9%	80,592	969	3,777	25.7%
CT 2.02, San Juan County	5,525	3,205	42.0%	81,719	842	5,367	15.7%
CT 2.04, San Juan County	2,626	644	75.5%	43,811	1,335	2,626	50.8%
CT 2.06, San Juan County	3,154	1,844	41.5%	34,240	2,021	3,103	65.1%
CT 2.07, San Juan County	1,905	1,008	47.1%	40,017	1,206	1,905	63.3%
CT 3.01, San Juan County	5,445	2,307	57.6%	57,857	1,704	5,445	31.3%
CT 3.02, San Juan County	3,053	1,583	48.1%	56,083	1,227	3,053	40.2%
CT 4.01, San Juan County	5,015	2,481	50.5%	46,705	2,725	4,863	56.0%
CT 4.02, San Juan County	4,323	1,371	68.3%	44,213	2,568	4,090	62.8%
CT 5.03, San Juan County	3,782	509	86.5%	46,881	2,092	3,781	55.3%
CT 5.04, San Juan County	1,770	639	63.9%	68,315	654	1,770	36.9%
CT 5.06, San Juan County	3,312	929	72.0%	58,688	1,487	3,312	44.9%
CT 5.07, San Juan County	2,201	1,406	36.1%	34,231	1,856	2,201	84.3%
CT 6.07, San Juan County	5,045	1,182	76.6%	53,942	1,706	4,236	40.3%

Analysis Unit	Total Population						
CT 6.09, San Juan County	1,112	770	30.8%	32,083	601	1,112	54.0%
CT 6.10, San Juan County	3,765	2,509	33.4%	44,184	1,973	3,757	52.5%
CT 6.11, San Juan County	2,804	2,180	22.3%	54,844	749	2,789	26.9%
CT 6.12, San Juan County	2,445	1,016	58.4%	49,375	1,225	2,374	51.6%
CT 6.13, San Juan County	4,414	2,843	35.6%	40,503	1,812	4,414	41.1%
CT 6.14, San Juan County	2,530	1,405	44.5%	71,053	981	2,530	38.8%
CT 6.15, San Juan County	2,906	1,305	55.1%	71,053	1,292	2,906	44.5%
CT 7.02, San Juan County	1,131	566	50.0%	67,917	220	1,114	19.7%
CT 7.05, San Juan County	3,436	1,351	60.7%	54,345	1,372	3,436	39.9%
CT 7.06, San Juan County	3,108	1,199	61.4%	46,685	1,483	3,108	47.7%
CT 7.07, San Juan County	3,744	1,503	59.9%	45,239	1,950	3,681	53.0%
CT 7.08, San Juan County	4,058	1,778	56.2%	51,071	1,791	4,038	44.4%
CT 9, San Juan County	1,860	1,041	44.0%	72,750	627	1,818	34.5%
CT 9428.01, San Juan County	2,679	11	99.6%	35,714	1,747	2,669	65.5%
CT 9428.02, San Juan County	6,282	92	98.5%	41,111	3,523	6,261	56.3%
CT 9428.03, San Juan County	2,751	56	98.0%	26,688	1,552	2,751	56.4%
CT 9429, San Juan County	4,527	34	99.2%	25,365	2,845	4,521	62.9%
CT 9430, San Juan County	3,964	29	99.3%	31,574	2,464	3,961	62.2%
CT 9431, San Juan County	2,065	17	99.2%	28,828	1,298	2,062	62.9%
CT 9432.01, San Juan County	5,701	663	88.4%	27,846	3,662	5,696	64.3%
CT 9433, San Juan County	1,903	1,181	37.9%	49,980	861	1,899	45.3%
PLACES							
Abiquiu, New Mexico	60	n/a	n/a	n/a	n/a	60	n/a
Alcalde, New Mexico	239	n/a	n/a	42,188	112	239	46.9%

Analysis Unit	Total Population						
Brazos, New Mexico	n/a	n/a	n/a	n/a	n/a	0	n/a
Canjilon, New Mexico	115	n/a	n/a	145,667	n/a	115	n/a
Cañones, New Mexico	50	n/a	n/a	n/a	9	50	18.0%
Canova, New Mexico	545	n/a	n/a	n/a	n/a	545	n/a
Chama village, New Mexico	1,002	142	85.8%	35,263	516	1,002	51.5%
Chamita, New Mexico	857	76	91.1%	52,857	269	846	31.8%
Chili, New Mexico	258	16	93.8%	53,664	n/a	258	n/a
Chimayo, New Mexico	3,208	244	92.4%	46,865	1,181	3,208	36.8%
Cordova, New Mexico	185	n/a	n/a	n/a	102	185	55.1%
Coyote, New Mexico	51	n/a	n/a	25,982	15	51	29.4%
Dixon, New Mexico	655	170	74.0%	39,598	230	655	35.1%
Dulce, New Mexico	2,607	31	98.8%	43,750	996	2,526	39.4%
El Duende, New Mexico	646	4	99.4%	n/a	597	646	92.4%
El Rito, New Mexico	898	25	97.2%	20,820	813	898	90.5%
Ensenada, New Mexico	285	n/a	n/a	n/a	27	285	9.5%
Española city, New Mexico	10,492	1,171	88.8%	42,611	4,702	10,434	45.1%
Gallina, New Mexico	393	73	81.4%	n/a	176	393	44.8%
Hernandez, New Mexico	954	121	87.3%	18,846	513	954	53.8%
La Madera, New Mexico	378	n/a	n/a	n/a	355	378	93.9%
La Mesilla, New Mexico	2,515	640	74.6%	66,586	545	2,515	21.7%
La Villita, New Mexico	936	47	95.0%	52,800	49	936	5.2%
Lindrith, New Mexico	108	105	2.8%	49,583	34	108	31.5%
Los Luceros, New Mexico	1,004	51	94.9%	51,488	265	1,004	26.4%
Los Ojos, New Mexico	78	n/a	n/a	n/a	32	78	41.0%
Lumberton, New Mexico	275	n/a	n/a	n/a	211	275	76.7%
Lybrook, New Mexico	396	69	82.6%	n/a	249	396	62.9%
Lyden, New Mexico	172	n/a	n/a	n/a	n/a	172	n/a
Medanales, New Mexico	146	n/a	n/a	n/a	67	146	45.9%
Ohkay Owingeh, New Mexico	1,445	23	98.4%	58,750	564	1,440	39.2%
Ojo Caliente, New Mexico	38	38	0.0%	n/a	n/a	38	n/a

Analysis Unit	Total Population						
Ojo Sarco, New Mexico	243	31	87.2%	n/a	65	243	26.7%
Pueblito, New Mexico	17	n/a	n/a	n/a	17	17	100.0%
Rio Chiquito, New Mexico	50	n/a	n/a	n/a	n/a	50	n/a
San Jose, New Mexico	784	65	91.7%	50,972	306	778	39.3%
Santa Clara Pueblo, New Mexico	833	10	98.8%	45,341	448	828	54.1%
Tierra Amarilla, New Mexico	471	45	90.4%	n/a	385	422	91.2%
Truchas, New Mexico	367	125	65.9%	n/a	108	367	29.4%
Velarde, New Mexico	241	n/a	n/a	n/a	192	241	79.7%
Youngsville, New Mexico	71	n/a	n/a	18,276	71	71	100.0%
Algodones CDP	993	211	78.8%	40,694	363	993	36.6%
Bernalillo town	9,049	2,621	71.0%	54,850	3,348	8,776	38.1%
Cañon CDP	372	68	81.7%	110,129	n/a	372	n/a
Cochiti CDP	459	5	98.9%	45,417	167	459	36.4%
Cochiti Lake CDP	399	237	40.6%	47,500	74	399	18.5%
Corrales village	8,488	5,808	31.6%	93,899	1,186	8,471	14.0%
Cuba village	522	35	93.3%	33,917	343	522	65.7%
Jemez Pueblo CDP	1,986	5	99.7%	50,000	1,013	1,971	51.4%
Jemez Springs village	375	245	34.7%	88,125	107	375	28.5%
La Cueva CDP	93	55	40.9%	142,375	n/a	93	n/a
La Jara CDP	290	23	92.1%	n/a	177	290	61.0%
La Madera CDP	447	298	33.3%	130,962	159	447	35.6%
Peña Blanca CDP	684	120	82.5%	51,071	321	684	46.9%
Placitas CDP	3,863	2,964	23.3%	89,809	418	3,863	10.8%
Ponderosa CDP	120	101	15.8%	50,481	49	120	40.8%
Pueblo of Sandia Village CDP	555	69	87.6%	17,917	325	555	58.6%
Rio Rancho city	102,403	47,601	53.5%	70,615	21,836	101,578	21.5%
Rio Rancho Estates CDP	1,087	306	71.8%	68,833	323	1,087	29.7%
San Felipe Pueblo CDP	1,868	5	99.7%	36,583	1,057	1,864	56.7%
San Luis CDP	185	8	95.7%	15,804	160	160	100.0%
Santa Ana Pueblo CDP	1,036	1	99.9%	54,545	434	1,036	41.9%
Santo Domingo Pueblo CDP	1,917	n/a	n/a	40,598	867	1,909	45.4%

Analysis Unit	Total Population						
San Ysidro village	195	19	90.3%	n/a	130	195	66.7%
Torreon CDP	456	135	70.4%	n/a	262	441	59.4%
Zia Pueblo CDP	873	n/a	n/a	48,125	531	871	61.0%
Angustura CDP	2,178	776	64.4%	47,583	1,023	2,178	47.0%
Aztec city	6,283	3,528	43.8%	46,509	3,329	6,204	53.7%
Beclabito CDP	220	n/a	n/a	46,875	107	220	48.6%
Blanco CDP	400	102	74.5%	n/a	144	400	36.0%
Bloomfield city	7,514	2,972	60.4%	47,284	3,560	7,451	47.8%
Cedar Hill CDP	736	615	16.4%	68,194	139	736	18.9%
Center Point CDP	2,377	1,878	21.0%	42,770	671	2,362	28.4%
Crouch Mesa CDP	4,997	2,072	58.5%	64,583	2,617	4,977	52.6%
Crystal CDP	305	n/a	n/a	33,125	174	305	57.0%
Farmington city	46,696	19,930	57.3%	56,045	19,075	45,220	42.2%
Flora Vista CDP	1,990	1,597	19.7%	38,666	822	1,990	41.3%
Fruitland CDP	249	31	87.6%	n/a	48	249	19.3%
Kirtland town	644	376	41.6%	97,500	94	644	14.6%
La Boca CDP	77	77	0.0%	n/a	n/a	77	n/a
Lake Valley CDP	111	n/a	n/a	43,150	18	111	16.2%
La Plata CDP	1,935	1,200	38.0%	49,861	877	1,931	45.4%
Lee Acres CDP	4,851	2,124	56.2%	41,172	2,316	4,851	47.7%
Middle Mesa CDP	292	118	59.6%	22,067	279	292	95.5%
Nageezi CDP	333	5	98.5%	n/a	224	333	67.3%
Napi Headquarters CDP	662	n/a	n/a	26,437	521	662	78.7%
Naschitti CDP	469	5	98.9%	n/a	337	466	72.3%
Navajo Dam CDP	354	116	67.2%	65,781	69	354	19.5%
Nenahnezad CDP	438	n/a	n/a	37,426	208	438	47.5%
Newcomb CDP	467	16	96.6%	26,458	314	467	67.2%
North Light Plant CDP	715	102	85.7%	n/a	494	715	69.1%
Ojo Amarillo CDP	478	n/a	n/a	19,500	338	478	70.7%
Sanostee CDP	366	n/a	n/a	27,500	211	366	57.7%
Sheep Springs CDP	377	n/a	n/a	22,750	276	374	73.8%
Shiprock CDP	8,452	144	98.3%	37,228	4,642	8,431	55.1%
South River CDP	1,382	975	29.5%	73,088	203	1,382	14.7%
Spencerville CDP	1,423	945	33.6%	66,845	615	1,423	43.2%
Totah Vista CDP	537	158	70.6%	26,491	489	537	91.1%

Analysis Unit	Total Population						
Turley CDP	366	149	59.3%	53,125	92	366	25.1%
Upper Fruitland CDP	1,566	16	99.0%	32,976	824	1,563	52.7%
Waterflow CDP	1,521	608	60.0%	54,345	606	1,521	39.8%
West Hammond CDP	2,329	1,212	48.0%	66,477	948	2,287	41.5%

*Sources: U.S. Census Bureau. 2017a, 2017b, 2022a, 2022b, 2023.

Table E.2. Identification of EJ communities in the Analysis Area by criteria

Analysis Unit	EJ Criteria[34] 1	EJ Criteria 2	EJ Criteria 3	EJ Criteria 4	EJ Criteria 5
CENSUS TRACTS					
CT 1, Rio Arriba County	YES	NO	NO	NO	NO
CT 2, Rio Arriba County	YES	NO	NO	NO	NO
CT 3.01, Rio Arriba County	YES	NO	NO	NO	NO
CT 3.02, Rio Arriba County	YES	NO	NO	NO	NO
CT 4.01, Rio Arriba County	YES	NO	NO	NO	YES
CT 4.02, Rio Arriba County	YES	NO	NO	YES	NO
CT 5, Rio Arriba County	YES	NO	NO	NO	YES
CT 9407, Rio Arriba County	YES	NO	YES	YES	YES
CT 9408, Rio Arriba County	YES	NO	NO	NO	YES
CT 9410, Rio Arriba County	YES	NO	YES	YES	YES
CT 9441, Rio Arriba County	YES	NO	NO	YES	YES
CT 105.03, Sandoval County	YES	YES	NO	YES	NO
CT 106.01, Sandoval County	NO	NO	NO	NO	NO
CT 106.02, Sandoval County	NO	NO	NO	NO	NO
CT 107.02, Sandoval County	NO	NO	NO	NO	NO
CT 107.05, Sandoval County	NO	NO	NO	NO	NO
CT 107.12, Sandoval County	YES	NO	NO	YES	NO
CT 107.13, Sandoval County	YES	NO	NO	YES	NO
CT 107.14, Sandoval County	NO	NO	NO	NO	NO
CT 107.15, Sandoval County	NO	NO	NO	NO	NO
CT 107.19, Sandoval County	YES	NO	NO	NO	NO
CT 107.21, Sandoval County	YES	NO	NO	YES	NO
CT 107.22, Sandoval County	YES	NO	NO	NO	NO
CT 107.24, Sandoval County	YES	YES	NO	NO	NO
CT 107.25, Sandoval County	YES	NO	NO	NO	YES
CT 107.26, Sandoval County	YES	NO	NO	NO	NO
CT 107.27, Sandoval County	YES	NO	NO	NO	NO
CT 107.28, Sandoval County	NO	NO	NO	NO	NO
CT 107.29, Sandoval County	YES	NO	NO	NO	NO
CT 107.30, Sandoval County	YES	NO	NO	NO	NO
CT 107.31, Sandoval County	YES	NO	NO	NO	NO
CT 107.32, Sandoval County	YES	NO	NO	YES	NO
CT 107.33, Sandoval County	YES	NO	NO	YES	NO
CT 107.34, Sandoval County	YES	NO	NO	YES	NO
CT 109, Sandoval County	YES	YES	YES	YES	YES
CT 111.01, Sandoval County	NO	NO	NO	NO	YES
CT 111.02, Sandoval County	NO	NO	NO	YES	YES
CT 112, Sandoval County	YES	YES	NO	YES	YES
CT 9402, Sandoval County	YES	YES	NO	YES	YES

[34] EJ Criteria are defined as follows:

EJ community of concern criterion 1: minority population higher than 50%

EJ community of concern criterion 2: minority population higher than 110% of reference area (county)

EJ community of concern criterion 3: low-income population higher than 50%

EJ community of concern criterion 4: low-income population higher than 100% of reference area (county)

EJ community of concern criterion 5: tribal communities

CT 9405, Sandoval County	YES	YES	YES	YES	YES
CT 9406, Sandoval County	YES	YES	NO	YES	YES
CT 9407, Sandoval County	YES	YES	NO	YES	YES
CT 9409, Sandoval County	YES	YES	YES	YES	YES
CT 9410, Sandoval County	YES	YES	NO	YES	YES
CT 9800, Sandoval County	n/a	n/a	n/a	n/a	NO
CT 1, San Juan County	YES	NO	NO	NO	NO
CT 2.01, San Juan County	NO	NO	NO	NO	NO
CT 2.02, San Juan County	NO	NO	NO	NO	NO
CT 2.04, San Juan County	YES	YES	YES	YES	NO
CT 2.06, San Juan County	NO	NO	YES	YES	NO
CT 2.07, San Juan County	NO	NO	YES	YES	NO
CT 3.01, San Juan County	YES	NO	NO	NO	NO
CT 3.02, San Juan County	NO	NO	NO	NO	NO
CT 4.01, San Juan County	YES	NO	YES	YES	NO
CT 4.02, San Juan County	YES	NO	YES	YES	NO
CT 5.03, San Juan County	YES	YES	YES	YES	NO
CT 5.04, San Juan County	YES	NO	NO	NO	NO
CT 5.06, San Juan County	YES	YES	NO	NO	NO
CT 5.07, San Juan County	NO	NO	YES	YES	NO
CT 6.07, San Juan County	YES	YES	NO	NO	NO
CT 6.09, San Juan County	NO	NO	YES	YES	NO
CT 6.10, San Juan County	NO	NO	YES	YES	NO
CT 6.11, San Juan County	NO	NO	NO	NO	NO
CT 6.12, San Juan County	YES	NO	YES	YES	NO
CT 6.13, San Juan County	NO	NO	NO	NO	NO
CT 6.14, San Juan County	NO	NO	NO	NO	NO
CT 6.15, San Juan County	YES	NO	NO	NO	NO
CT 7.02, San Juan County	NO	NO	NO	NO	YES
CT 7.05, San Juan County	YES	NO	NO	NO	NO
CT 7.06, San Juan County	YES	NO	NO	NO	NO
CT 7.07, San Juan County	YES	NO	YES	YES	NO
CT 7.08, San Juan County	YES	NO	NO	NO	NO
CT 9, San Juan County	NO	NO	NO	NO	NO
CT 9428.01, San Juan County	YES	YES	YES	YES	YES
CT 9428.02, San Juan County	YES	YES	YES	YES	YES
CT 9428.03, San Juan County	YES	YES	YES	YES	YES
CT 9429, San Juan County	YES	YES	YES	YES	YES
CT 9430, San Juan County	YES	YES	YES	YES	YES
CT 9431, San Juan County	YES	YES	YES	YES	YES

CT 9432.01, San Juan County	YES	YES	YES	YES	YES
CT 9433, San Juan County	NO	NO	NO	NO	YES
PLACES					
Abiquiu, New Mexico	YES	NO	NO	NO	NO
Alcalde, New Mexico	YES	NO	NO	YES	YES
Brazos, New Mexico	YES	NO	NO	NO	NO
Canjilon, New Mexico	YES	NO	NO	NO	NO
Cañones, New Mexico	YES	NO	NO	NO	NO
Canova, New Mexico	YES	NO	NO	NO	NO
Chama village, New Mexico	YES	NO	YES	YES	YES
Chamita, New Mexico	YES	NO	NO	NO	YES
Chili, New Mexico	YES	NO	NO	YES	NO
Chimayo, New Mexico	YES	YES	NO	YES	NO
Cordova, New Mexico	YES	NO	NO	NO	NO
Coyote, New Mexico	YES	NO	NO	NO	NO
Dixon, New Mexico	YES	NO	NO	NO	NO
Dulce, New Mexico	YES	YES	NO	NO	YES
El Duende, New Mexico	YES	YES	YES	YES	YES
El Rito, New Mexico	YES	YES	YES	YES	NO
Ensenada, New Mexico	YES	NO	NO	NO	NO
Española city, New Mexico	YES	NO	NO	YES	YES
Gallina, New Mexico	YES	NO	NO	YES	NO
Hernandez, New Mexico	YES	NO	YES	YES	YES
La Madera, New Mexico	YES	NO	NO	YES	NO
La Mesilla, New Mexico	YES	NO	NO	NO	YES
La Villita, New Mexico	YES	NO	NO	NO	YES
Lindrith, New Mexico	NO	NO	NO	NO	NO
Los Luceros, New Mexico	YES	NO	NO	NO	NO
Los Ojos, New Mexico	YES	NO	NO	NO	NO
Lumberton, New Mexico	YES	NO	NO	NO	NO
Lybrook, New Mexico	YES	NO	YES	YES	YES
Lyden, New Mexico	YES	NO	NO	NO	NO
Medanales, New Mexico	YES	NO	NO	YES	NO
Ohkay Owingeh, New Mexico	YES	YES	NO	NO	YES
Ojo Caliente, New Mexico	YES	NO	NO	YES	NO
Ojo Sarco, New Mexico	YES	NO	NO	NO	NO
Pueblito, New Mexico	YES	NO	NO	YES	YES
Rio Chiquito, New Mexico	YES	YES	NO	YES	NO
San Jose, New Mexico	YES	NO	NO	NO	YES
Santa Clara Pueblo, New Mexico	YES	YES	YES	YES	YES

Tierra Amarilla, New Mexico	YES	NO	YES	YES	NO
Truchas, New Mexico	YES	NO	NO	NO	NO
Velarde, New Mexico	YES	NO	NO	NO	NO
Youngsville, New Mexico	YES	NO	NO	NO	NO
Algodones CDP	YES	YES	NO	YES	YES
Bernalillo town	YES	YES	NO	YES	YES
Cañon CDP	YES	YES	NO	YES	YES
Cochiti CDP	YES	YES	NO	YES	YES
Cochiti Lake CDP	NO	NO	NO	NO	YES
Corrales village	NO	NO	NO	NO	YES
Cuba village	YES	YES	YES	YES	NO
Jemez Pueblo CDP	YES	YES	YES	YES	YES
Jemez Springs village	NO	NO	NO	YES	NO
La Cueva CDP	YES	YES	NO	YES	NO
La Jara CDP	YES	YES	YES	YES	NO
La Madera CDP	NO	NO	NO	YES	NO
Peña Blanca CDP	YES	YES	NO	YES	YES
Placitas CDP	NO	NO	NO	NO	YES
Ponderosa CDP	NO	NO	NO	YES	YES
Pueblo of Sandia Village CDP	YES	YES	YES	YES	YES
Rio Rancho city	YES	NO	NO	NO	YES
Rio Rancho Estates CDP	YES	YES	NO	YES	NO
San Felipe Pueblo CDP	YES	YES	YES	YES	YES
San Luis CDP	YES	YES	YES	YES	NO
Santa Ana Pueblo CDP	YES	YES	NO	YES	YES
Santo Domingo Pueblo CDP	YES	YES	NO	YES	YES
San Ysidro village	YES	YES	YES	YES	YES
Torreon CDP	YES	YES	YES	YES	YES
Zia Pueblo CDP	YES	YES	NO	YES	YES
Angustura CDP	YES	NO	NO	NO	NO
Aztec city	NO	NO	YES	YES	NO
Beclabito CDP	YES	YES	YES	YES	YES
Blanco CDP	YES	YES	NO	NO	NO
Bloomfield city	YES	NO	NO	NO	NO
Cedar Hill CDP	NO	NO	NO	NO	YES
Center Point CDP	NO	NO	NO	NO	NO
Crouch Mesa CDP	YES	NO	YES	YES	NO
Crystal CDP	YES	YES	YES	YES	YES
Farmington city	YES	NO	NO	NO	YES
Flora Vista CDP	NO	NO	NO	NO	NO
Fruitland CDP	YES	YES	NO	NO	YES

Kirtland town	NO	NO	NO	NO	NO
La Boca CDP	YES	NO	NO	NO	YES
Lake Valley CDP	YES	YES	YES	YES	YES
La Plata CDP	NO	NO	NO	NO	YES
Lee Acres CDP	YES	NO	NO	NO	NO
Middle Mesa CDP	YES	NO	YES	YES	YES
Nageezi CDP	YES	YES	YES	YES	YES
Napi Headquarters CDP	YES	YES	YES	YES	YES
Naschitti CDP	YES	YES	YES	YES	YES
Navajo Dam CDP	YES	NO	NO	NO	NO
Nenahnezad CDP	YES	YES	YES	YES	YES
Newcomb CDP	YES	YES	YES	YES	YES
North Light Plant CDP	YES	YES	YES	YES	NO
Ojo Amarillo CDP	YES	YES	YES	YES	YES
Sanostee CDP	YES	YES	YES	YES	YES
Sheep Springs CDP	YES	YES	YES	YES	YES
Shiprock CDP	YES	YES	YES	YES	YES
South River CDP	NO	NO	NO	NO	NO
Spencerville CDP	NO	NO	NO	NO	NO
Totah Vista CDP	YES	YES	YES	YES	NO
Turley CDP	YES	NO	NO	NO	NO
Upper Fruitland CDP	YES	YES	YES	YES	YES
Waterflow CDP	YES	NO	NO	NO	YES
West Hammond CDP	NO	NO	NO	NO	YES

APPENDIX F. COMMENTS RECEIVED DURING THE 2024-2025 PUBLIC COMMENT PERIOD AND BLM'S RESPONSE TO SUBSTANTIVE COMMENTS

The BLM evaluated all comments received and parsed them into substantive or non-substantive comments according to the guidance in the BLM's NEPA Handbook (BLM 2008:66). The substantive comments in Table F.1 are representative of the topics raised, and single responses are provided for similarly stated topics.

Table F-2. Substantive Comment Topics and Responses

Comment Text	Response
Recent and upcoming legislation, rulemaking, and regulatory changes do not absolve BLM of its duties under NEPA, FLPMA, the ESA, the APA, and all other applicable laws and regulations. The agency cannot rely on emissions reductions goals or other measures in statutes like the Inflation Reduction Act to avoid analyzing, disclosing, and attempting to mitigate or avoid the impacts of oil and gas leasing.	To the extent the comment does not allege a specific error in the BLM's analysis, the BLM considers it non-substantive. Generally, the BLM makes mineral resources, such as oil and gas, available for development in accordance with laws including the MLA and FLPMA. See EA Sections 1.2 and 1.4 for information regarding the BLM's requirements under MLA, FLPMA, and other statutes and regulations. Chapter 2 of the 2022 BLM Specialist Report on Annual Greenhouse Gas Emissions and Climate Trends, incorporated in the EA by reference, discusses the relationship between BLM's coal, oil, and gas leasing programs with other laws and policies at the federal and state level.
BLM Is Not Required to Hold a Lease Sale or Issue Any Leases—Even Following the Passage of the Inflation Reduction Act.	To the extent that this comment relies on an interpretation of the IRA, the BLM considers it non-substantive, because legal authorities are the best evidence of their contents. To the extent that this comment relates to agency-wide compliance with the IRA, it is outside the scope of this NEPA analysis. The decision under review is "whether to make available for lease the nominated lease parcels with or without constraints, in the form of lease stipulations, as provided for in the approved land use plan." See EA Section 1.3. Generally, the need for the action is established by the BLM's responsibility under the MLA, as amended, is to make mineral resources, such as oil and gas, available for development. See EA Sections 1.2 and 1.4 for information regarding the BLM's requirements under MLA, FLPMA, and other statutes and regulations. BLM issued updated oil and gas leasing guidance on November 21, 2022, which includes seven IMs, that will enable consistent implementation of the IRA's changes to agency's oil and gas programs. See Section 1.4.2 and Appendix C of the EA for more details.

The BLM May Not Assume GHG Reductions based on Passage of the IRA.	To the extent this comment relies on an interpretation of the IRA, the BLM considers it non-substantive because legal authorities are the best evidence of their contents. The BLM analyzes potential impacts from climate change and GHG in detail in the EAs (see Sections 3.6.1 and 3.6.2). The BLM quantifies direct, indirect, and cumulative emissions from the combustion of oil and gas and discusses the significance of these emissions. The BLM takes a hard look at the environmental impacts of leasing, including quantifying and forecasting aggregate GHG emissions from oil and gas development and addressing the environmental effects of downstream oil and gas use including the effects on climate change. The EA also incorporates by reference the 2022 ARTR as well as the 2022 BLM Specialists Report on Annual Greenhouse Gas Emissions and Climate Trends which provides a more comprehensive assessment of cumulative emissions, climate change impacts, and reputable climate science sources. The EA analysis does not assume GHG reductions based on passage of the IRA; rather, it analyzes anticipated emissions of the parcels being considered for sale and cumulative emissions for the relevant planning area, in a variety of contexts.
BLM must disclose which wind or solar rights-of-way are supported by the New Mexico oil and gas lease sale and should establish publicly accessible tracking for renewable rights-of-way. The IRA, and now BLM, tie issuance of rights-of-way for wind and solar development on public lands to recent issuance of oil and gas leases within the last 120 days (and offers for lease within the last year). Accordingly, BLM must identify which renewable development rights-of-way the proposed New Mexico oil and gas lease sale will facilitate. While BLM's April 2023 Instruction Memorandum 2023-036, "Inflation Reduction Act Conditions for Issuing Rights-of-Way for Solar or Wind Energy Development," provides the agency instructions for issuing rights-of-way in compliance with the IRA, it does not identify the specific rights-of-way under consideration. BLM must provide information on upcoming wind or solar rights-of-way to the public through this NEPA process and make available any publicly-accessible tracking system for renewable rights-of-way that are under consideration. BLM must explain in its NEPA reviews which specific renewable rights-of-way are facilitated by these decisions. For the sake of efficiency and transparency, given the leasing provisions of the IRA, Commenters further request that in addition to providing this information in specific NEPA reviews, BLM establish a publicly-accessible system for tracking potential and recently-issued rights-of-way for wind and solar development on public lands.	The decision under review is "whether to make available for lease the nominated lease parcels with or without constraints, in the form of lease stipulations, as provided for in the approved land use plan." See EA Section 1.3. To the extent this comment seeks to interpret the IRA and IM 2023-036, the BLM considers it non-substantive because those authorities are the best evidence of their contents. These parcels will not contribute to IRA statistics as they were offered for sale in 2019.

BLM's NEPA Analysis must Address whether any Proposed Leasing is Consistent with U.S. Climate Commitments, and Address Its Full Costs and Benefits. BLM has failed to adequately address national climate policy in the draft EA for the proposed lease sale. Relatedly, BLM's NEPA analysis must address the social and economic costs resulting from development of any leases it offers, and explain what benefits warrant incurring those costs. We appreciate that the draft EA includes the social cost of greenhouse gases (SC-GHG) metric. Draft EA at 89. However, while BLM uses this metric to project that foreseeable development would cause millions of dollars in social and environmental harms, BLM provides no analysis on why it would choose to incur such enormous societal costs by proceeding with leasing, nor any discussion of how its cost analysis informs the agency's decision making.	The decision under review is "whether to make available for lease the nominated lease parcels with or without constraints, in the form of lease stipulations, as provided for in the approved land use plan." See EA Section 1.3. To the extent the comment raises issues outside the scope of this decision, the BLM considers it non-substantive. It is also non-substantive to the extent it purports to interpret legal authorities, because those authorities are the best evidence of their contents. In drafting the EA, the BLM adhered to its NEPA regulation at 40 C.F.R. § 1501.5,* which provides, in relevant part, that an EA "shall … [b]riefly … discuss the [purpose and need for the proposed agency action, alternatives as required by … NEPA .., and the [e]nvironmental effects of the proposed action and alternatives" (emphasis added). This regulation does not contemplate a cost-benefit analysis. BLM's regulation at 40 C.F.R. § 1502.22, which does contemplate a cost-benefit analysis, specifically applies to Environmental Impact Statements (EISs), which are necessarily more comprehensive. However, even for EISs, "agencies need not display the weighing of the merits and drawbacks of the various alternatives in a monetary cost-benefit analysis and should not do so when there are important qualitative considerations." 40 C.F.R. § 1502.22. Moreover, even in EISs, the BLM should focus on factors "that are likely to be relevant and important to a decision." Generally, the BLM analyzes impacts associated with the alternatives using the best available information, which is typically not monetized estimates of benefits or costs. The BLM analyzes potential impacts, including cumulative impacts, from climate change and greenhouse gases (GHGs) in detail in the environmental assessment (EA), Sections 3.6.1 and 3.6.2. The EA incorporates by reference information from the 2022 ARTR. The emissions used in this analysis are estimated using the BLM Lease Sale Emissions Tool and evaluated with the U.S. Environmental Protection Agency (EPA) GHG equivalency calculator. The BLM estimates the social cost of GHG emissions from its proposed action in the EA. While these numbers provide a monetized measure of the net harm to society from emissions, they do not constitute a complete cost-benefit analysis of management actions under considerations and do not present a direct comparison with other impacts discussed in the EA. SC-GHG estimates are provided only as a useful measure of the benefits of GHG emissions reductions to inform agency decision-making. *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 C.F.R. Part 46, to meet the agency's obligations under NEPA, 42 U.S.C. §§ 4321 *et seq*.

WORC v. BLM requires BLM to analyze the climate and non-climate public health effects of downstream use of fossil fuels from oil and gas leases.	To the extent this comment purports to interpret legal authorities that are the best evidence of their contents, the BLM considers it non-substantive. The cited court order applies specifically to NEPA analysis conducted in the Buffalo, Wyoming Field Office, which is separate and distinct from the analysis conducted in the EA at issue here. The Protesting Party has not provided any judicial orders or opinions bearing directly on the public health analyses in the EA; therefore, the BLM assumes they do not exist. The EA analyzes potential human health impacts in AIB-19, including non-climate related health effects associated with 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; traffic congestion and collisions from commercial vehicles and heavy use; infrequent industrial accidents; presence of hydrogen sulfide (H2S); or increased levels of fugitive dust (PM10 and PM2.5), other criteria pollutants, VOCs, and hazardous air pollutants (HAPs). The BLM also discloses potential downstream and indirect effects of the leasing decision in Section 3.6.1 on air quality, specifically Section 3.6.1.2, Environmental Effects. Additional information regarding the human health and safety effects of climate change can be found in the 2022 BLM Specialist Report on Annual GHG Emissions and Climate Trends, which is incorporated by reference into the EA. The comment does not allege any specific inadequacies or inaccuracies within these analyses or submit new substantive information that the BLM could consider.
BLM Must Prepare an EIS to Address the Cumulative Impacts of All Lease Sales Proposed for 2024. It is arbitrary and capricious to conclude that leasing on such a scale is not significant. As a result, all 16 parcels for the New Mexico March and June 2019 lease sale, listed in Appendix A, in addition to the parcels proposed to-date for lease in other states, require the preparation of such an EIS.	NEPA allows agencies to prepare an EA "on any action at any time in order to assist agency planning and decisionmaking." 43 C.F.R. § 1501.3; see also 40 C.F.R. § 1501.5 (describing "environmental assessment"). An agency need not prepare an EIS if it determines the action will not have significant effect on the human environment or where such effects may be mitigated by adoption of appropriate measures. See 42 U.S.C. § 4332(C)(2) (requiring a detailed statement for federal actions "significantly affecting the quality of the human environment"); 40 C.F.R. § 1501.6 (finding of no significant impact); accord *Monsanto Co. v. Geertson Seed Farms*, 561 U.S. 139, 145 (2010) ("An agency need not complete an EIS for a particular proposal if it finds, on the basis of a shorter [EA], that the proposed action will not have a significant impact on the environment.") (citations omitted). Whether the Federal action "significantly" affects the human environment is defined in terms of the "context" and "intensity" of that action as set forth at 40 C.F.R. § 1501.3. Context refers to the scope of a proposed action, including the interests affected. Intensity refers to "the severity of the impact" and requires consideration of the factors set forth in 40 C.F.R. § 1501.3(d)(2). If the agency concludes that the action will not significantly impact the environment, or may be sufficiently mitigated, it may issue a FONSI. 40 C.F.R. § 1501.6. The BLM's environmental analysis for the March and June 2019 Lease Sale is consistent with the purpose and requirements of NEPA.

Moreover, while BLM does also quantify GHG emissions globally, nationally, and in New Mexico from 2016-2021, Draft EA at 101-102, the agency fails to take a hard look at the reasonably foreseeable climate impacts of those emissions, fails to define or indicate a significance threshold for those emissions and impacts, and otherwise provides no meaningful context for those emissions and impacts, either relative to other contemporaneous lease sales or with respect to BLM's oil and gas program as a whole. This is contrary to NEPA and the APA. The Tenth Circuit's February 2023 decision in *Dine Citizens Against Ruining Our Env't v. Haaland*, 59 F.4th 1016 (10th Cir. 2023) is instructive here. In that case, the court rightly recognized that "all agency actions causing an increase in GHG emissions will appear de minimis when compared to the regional, national, and global numbers." And "[W]here BLM neither applied the carbon budget method nor explained why it did not, BLM acted arbitrarily and capriciously by failing to consider the impacts of the projected GHGs." BLM must use an accepted methodology, such as the global carbon budget, to analyze the significance of new emissions and put them into context.	The BLM considers this comment non-substantive to the extent that it seeks to interpret legal authorities that are the best evidence of their contents. The BLM analyzes potential impacts from climate change and GHG in detail in the EAs (see Sections 3.6.1 and 3.6.2). The BLM quantifies direct, indirect, and cumulative emissions from the combustion of oil and gas and discusses the significance of these emissions. The BLM takes a hard look at the environmental impacts of leasing, including quantifying and forecasting aggregate GHG emissions from oil and gas development and addressing the environmental effects of downstream oil and gas use including the effects on climate change. The EA also incorporates by reference the 2022 ARTR as well as the 2022 BLM Specialists Report on Annual Greenhouse Gas Emissions and Climate Trends (Annual GHG Report) which provides a more detailed assessment of cumulative emissions, climate change impacts, and reputable climate science sources. Carbon budgets estimate 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 Intergovernmental Panel on Climate Change's (IPCC's) Special Report on Global Warming of 1.5ºC is the most widely accepted authority on the development of a carbon budget to meet the goals of the Paris Agreement. At present, no national or federal agency carbon budgets have been established, 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. Additionally, the Council on Environmental Quality (CEQ) 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." 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 and the BLM has done so in its Annual GHG Report.

BLM's analysis of the no-leasing or no action alternative is incomplete and insufficient to adequately inform the public and the decision maker. The impacts to GHG emissions and climate for the no action alternative (under which the parcels could not be leased) considered in the EA are brief and fail to indicate the difference in estimated GHG emissions between the proposed alternatives and the no action alternative. See, e.g., Draft EA at 103. The 2016 CEQ GHG Guidance indicates that in the alternatives analysis, agencies should compare anticipated levels of GHG emissions from each alternative, including the no-action alternative, and mitigation actions to provide information to the public and enable the decision maker to make an informed decision.57 The 2023 Interim CEQ Guidance further underscores the importance of considering alternatives that would avoid or mitigate GHG emissions.58 The analysis of the no-action alternative also asserts that Federal production levels would remain static or even increase if the leases are not developed, a "perfect substitution" argument that courts have repeatedly rejected. See, e.g. Friends of the Earth v. Haaland, No. CV 21-2317 (RC), 2022 WL 254526, at *12 (D.D.C. Jan. 27, 2022) (finding argument that no action alternative would result in higher emissions arbitrary); WildEarth Guardians v. United States Bureau of Land Mgmt., 870 F.3d 1222, 1238 (10th Cir. 2017) (irrational and unsupported substitution argument arbitrary).	The BLM considers this comment non-substantive to the extent it seeks to interpret legal authorities, which are the best evidence of their content. NEPA directs the BLM to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal that involves unresolved conflicts concerning alternative uses of available resources." 42 U.S.C. § 4332(E). BLM NEPA Handbook H-1790-1 and CEQ guidance direct the BLM to evaluate the proposed action, the no action alternative as a baseline, and other "Reasonable Alternatives" that meet the BLM's Purpose and Need and are within the BLM's authority. The BLM is not required to evaluate alternatives that do not meet the BLM's Purpose and Need, are not within the BLM's discretion, or which are precluded by law. The alternatives considered adequately weigh the courses of actions that BLM could take based on potential resource conflicts and whether making certain lands available would meet the purpose and need of the EA. A description of the BLM's decision space based on the alternatives analyzed in detail is provided in EA Sections 1.3 and 2.1. As informed by the issue-based analysis in the EA, the BLM Authorized Officer retains the discretion to lease none, some, or all of the nominated lease parcels. The BLM's charge in preparing an EA is to "[b]riefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact." 40 C.F.R. § 1501.5; compare 40 C.F.R. § 1502.14 (setting forth more rigorous requirements for alternatives analysis in an EIS). The regulation pertaining to EAs does not contemplate an exhaustive treatment of the "no action" alternative, and in this case the BLM analyzed the "no action" alternative in sufficient detail to establish a baseline against which to assess impacts of the proposed action. The BLM has disclosed the GHG emissions from the Proposed Action and provided context for those emissions compared to existing federal onshore GHG emissions in the state and nationally. The BLM has also included an evaluation of the climate change impacts that could result from the proposed action and incorporated by reference the 2022 BLM Specialists Report on Annual Greenhouse Gas Emissions and Climate Trends, which provides a more comprehensive assessment of cumulative emissions, climate change impacts, and reputable climate science sources. If or when a proposed action for development is submitted, the BLM can determine appropriate mitigation measures to reduce or offset GHG emissions that are not already required by law or proposed by the operator. Climate impacts are among many factors that the BLM considers in the NEPA analysis to evaluate the significance of a proposed leasing action.

BLM must consider alternatives that would protect usable groundwater. See *WildEarth Guardians v. U.S. Bureau of Land Mgmt*., 457 F.Supp.3d 880, 890 (D. Mont. 2020). Specifically, BLM should consider not leasing parcels within areas where there is less than 2,000 feet of vertical separation between the oil and gas formations likely to be targeted and any groundwater aquifer with 10,000 ppm TDS or less. BLM should also analyze an alternative whereby parcels would not be leased in areas overlying usable groundwater and surface water, and an alternative that includes other measures to ensure that all usable groundwater zones are protected. This might involve pre-leasing groundwater testing and adding a lease stipulation or lease notice requiring specified casing and cementing depths. Alternatively, or additionally, BLM should consider requiring a lease stipulation or lease notice requiring the lessee to perform groundwater testing prior to drilling to identify all usable water, and consultation with the U.S. Geological Survey and other agencies to identify those waters with up to 10,000 ppm TDS. BLM did not consider such an alternative.	NEPA directs the BLM to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal that involves unresolved conflicts concerning alternative uses of available resources." 42 U.S.C. 4332(E). Additionally, BLM NEPA Handbook H-1790-1, and CEQ guidance, direct the BLM to evaluate the proposed action, the no action alternative as a baseline, and other "Reasonable Alternatives" that meet the BLM's Purpose and Need and are within the BLM's authority. The BLM is not required to evaluate alternatives that do not meet the BLM's Purpose and Need, are not within the BLM's discretion, or which are precluded by law. The commenter does not identify what, if any, unresolved resource conflict associated with the Lease Sale would be resolved by consideration of this alternative, nor how such a proposal would be reasonably implemented. The BLM analyzed groundwater quality impacts at AIB-1, incorporating by reference the 2023 BLM Water Support Document for Oil and Gas Development in New Mexico. In this analysis, the BLM described numerous requirements for oil and gas producers so that drilling fluids, hydraulic fracturing fluids, and produced water and hydrocarbons remain within the well bore and do not enter groundwater or any other formations. With these requirements in place, including the use of casing and cementing measures, contamination of groundwater resources from the nominated lease parcels is highly unlikely. Specifically with regard to casing requirements, under 43 C.F.R. § 3172, casing and cementing programs are conducted to protect and/or isolate all usable water zones, lost circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. The casing setting depth is calculated to position the casing seat opposite a competent formation that will contain the maximum pressure to which it will be exposed during normal drilling operations. Determination of casing setting depth is based on all relevant factors, including presence/absence of hydrocarbons; fracture gradients; usable water zones; formation pressures; lost circulation zones; other minerals; or other unusual characteristics. Any isolating medium other than cement shall receive approval prior to use. See Appendix D. There have been no documented instances of groundwater contamination attributed to well drilling and completion in the FFO, which underscores the effectiveness of the BLM's approach to protecting groundwater. In addition, the BLM has authority under STCs to require additional measures to protect water quality if site-specific circumstances require them. Site-specific mitigation tools would be developed as appropriate for the individual circumstances, including groundwater-quality monitoring studies. The regulations at 43 C.F.R. § 3162.5-2(d) give the BLM the authority to require an operator to monitor water resources to ensure that the isolation procedures used to protect water and other resources are effective. Aside from suggesting groundwater as the basis for an added alternative, the commenter has not alleged any deficiency in the BLM's groundwater quality analysis or provided any new information for the BLM to consider.

BLM must include in their analysis an alternative that applies a stipulation that mandates the use of best available methane reduction technologies to parcels. Recent research has demonstrated that the use of ten technically proven and commercially available methane emissions reduction technologies can together capture more than 80 percent of the methane currently going to waste in the oil and gas sector's operations. See Harvey Report referenced above. These technologies include: • Green Completions to capture oil and gas well emissions; • Plunger Lift Systems or other well deliquification methods to mitigate gas well emissions; • Tri-Ethylene Glycol (TEG) Dehydrator Emission Controls to capture emissions from dehydrators; • Desiccant Dehydrators to capture emissions from dehydrators; • Dry Seal Systems to reduce emissions from centrifugal compressor seals; • Improved Compressor Maintenance to reduce emissions from reciprocating compressors; • Low-Bleed or No-Bleed Pneumatic Controllers used to reduce emissions from control devices; • Pipeline Maintenance and Repair to reduce emissions from pipelines; • Vapor Recovery Units used to reduce emissions from storage tanks; and • Leak Monitoring and Repair to control fugitive emissions from valves, flanges, seals, connections and other equipment.	NEPA directs the BLM to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal that involves unresolved conflicts concerning alternative uses of available resources." 42 U.S.C. 4332(E). Additionally, BLM NEPA Handbook H-1790-1, and CEQ guidance, direct the BLM to evaluate the proposed action, the no action alternative as a baseline, and other "Reasonable Alternatives" that meet the BLM's Purpose and Need and are within the BLM's authority. The BLM is not required to evaluate alternatives that do not meet the BLM's Purpose and Need, are not within the BLM's discretion, or which are precluded by law. The Bureau of Land Management updated its regulations in March of 2024 to reduce the waste of natural gas from oil and gas operations on federal and Tribal lands. The BLM's Waste Prevention, Production Subject to Royalties, and Resource Conservation Rule, known as the Waste Prevention Rule, revises 43 C.F.R. §§ 3160 and 3170 to help curb waste of natural gas from flaring, venting, and leaks, and provide a fair return for federal taxpayers, Tribes, and states. The Waste Prevention Rule leverages technological advances made during the last 40 years, as well as industry best practices, to help achieve natural gas waste reductions. In fact, many oil and gas operators are already voluntarily taking steps to reduce natural gas waste and improve operational efficiency in ways that often comply with requirements in the rule. The rule's requirements regarding safety, storage tanks, and leak detection and repair apply to operations on Federal or Tribal surface lands in New Mexico. BLM's rule updates the BLM's outdated natural gas waste regulations to better address the Secretary of the Interior's obligation, under the MLA, to prevent avoidable waste of natural gas from oil and gas operations. Additionally, oil and gas operations in New Mexico are subject to New Mexico's Natural Gas Capture Requirements (Waste Prevention Rule), NMAC 19.15.27, and the "Oil and Natural Gas Regulation for Ozone Precursors" rule, NMAC 20.2.50.1, including emissions reduction requirements for compressors, engines and turbines, liquids unloading, dehydrators, heaters, pneumatics, storage tanks, and pipeline inspection gauge launching and receiving. The regulation also encourages operators to stop venting and flaring and use fuel cells technology to convert CH4 to electricity at the well site and incentivizes new technology for leak detection and repair. Approximately 50,000 wells and associated equipment will be subject to this regulation. It is anticipated that the regulation will annually reduce VOC emissions by 106,420 tons, NOX emissions by 23,148 tons, and methane (CH4) emissions by 200,000 to 425,000 tons statewide. Analysis and approval of future development may include application of BMPs within BLM's authority, as COAs or lease stipulations, to reduce or mitigate GHG emissions. Additional measures proposed at the project development stage also 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.

In addition to these best available methane reduction technologies, BLM must also consider an alternative that implements its legal obligation to use all reasonable precautions to prevent waste, including a stipulation on leases that provides for no routine venting or flaring, similar to regulations that are already being implemented in the states of Colorado and New Mexico. Although BLM has completed a rulemaking effort pursuant to its authority to prevent waste under 30 U.S.C. §§ 187, 225, BLM's proposed rule does not go nearly far enough to prevent waste from routine flaring on BLM managed leases on Tribal and federal public lands. Until methane waste is adequately addressed, BLM should not be holding lease sales or issuing leases, much less granting applications for permits to drill. Failing this, however, BLM must, at a minimum, use its existing authority under Notice to Lessees 4a (Jan. 1, 1980) ("NTL-4A) and the Inflation Reduction Act to condition such leases as it does issue to limit the environmental and human health harms caused by routine venting and flaring and to safeguard Tribal and publicly held resources from unreasonable and undue waste. Interior's standard lease form, Form 3100-11 (October 2008) provides, in section 4, that a "[l]essee … must prevent unnecessary damage to, loss of, or waste of leased resources," and that Interior "reserves right to specify rates of development and production in the public interest …". Such an alternative must also articulate the implementation of existing methane waste policies as described in NTL-4A and provide guidance requiring strict compliance with, at a minimum, NTL-4a's existing measures as well as BLM's legal authority and responsibility pursuant to the Federal Land Policy and Management Act to prevent or reduce methane emissions, independent of the agency's MLA duty to prevent waste. In addition, such an alternative could involve the following mechanisms to prevent methane waste: • Removal of a lease parcel from proposed sale or denial of an application for permit to drill if Interior determines that methane, nitrogen oxides, or other harmful emissions are impermissible, whether because such emissions would constitute waste or impair or cause undue or unnecessary harm to non-mineral public lands resources and values, in particular but not exclusively "air and atmospheric" values. • Controlling the timing, location, and pace of new drilling as well as the rate of production of new or existing wells to eliminate methane or other harmful emissions to align new drilling and production with midstream system capacity. • A requirement, whether via stipulation or condition of approval, that a lessee or operator, once flowback establishes the level of gas production, connect an oil well producing associated gas to a natural gas line with sufficient capacity prior to the commencement of full production. • A menu of drilling-stage of conditions of approval specifying known and readily available practices or technologies typically employed to reduce methane waste in accord with the MLA or methane and other harmful emissions in	The BLM considers this comment non-substantive to the extent it seeks to interpret legal authorities that are the best evidence of their contents. The decision under review is "whether to make available for lease the nominated lease parcels with or without constraints, in the form of lease stipulations, as provided for in the approved land use plan." See EA Section 1.3. Complaints about separate federal actions, including BLM rulemakings, are outside the scope of this decision. Following the publication of BLM's Waste Prevention Rule in March of 2024, NTL-4A no longer applies to oil and gas operations in New Mexico.

accord with FLPMA. Again, BLM attempts to defer a hard-look analysis of methane waste impacts, or consideration of alternatives that eliminate or mitigate those impacts, to the APD stage. EA at 87-88.	
… although BLM provided SC-GHG, it failed to provide any analysis of the decision making pursuant to those numbers. See, e.g., Draft EA at 102.	The BLM analyzes potential impacts from climate change and GHG in detail in the EAs (see Sections 3.6.1 and 3.6.2). The BLM quantifies direct, indirect, and cumulative emissions from the combustion of oil and gas and discusses the significance of these emissions. The BLM takes a hard look at the environmental impacts of leasing, including quantifying and forecasting aggregate GHG emissions from oil and gas development and addressing the environmental effects of downstream oil and gas use including the effects on climate change. The EA also incorporates by reference the 2022 ARTR as well as the 2022 BLM Specialists Report on Annual Greenhouse Gas Emissions and Climate Trends which provides a more comprehensive assessment of cumulative emissions, climate change impacts, and reputable climate science sources. The EA analysis does not assume GHG reductions based on passage of the IRA; rather, it analyzes anticipated emissions of the parcels being considered for sale and cumulative emissions for the relevant planning area, in a variety of contexts. The BLM estimates the social cost of GHG emissions from its proposed action in the EA. While these numbers provide a monetized measure of the net harm to society from emissions, they do not constitute a complete cost-benefit analysis of management actions under considerations and do not present a direct comparison with other impacts discussed in the EA. SC-GHG estimates are provided only as a useful measure of the benefits of GHG emissions reductions to inform agency decision-making.
BLM Has the Ability to Provide For Meaningful And Measurable Mitigation Actions In The Context of Cumulative Climate Change Resulting From Global Emissions. Throughout the BLM Specialist Report and the EA for the proposed lease sale, BLM mischaracterizes its duty and authority to address climate change programmatically and in the context of project level actions. BLM's mischaracterizations misinform the public and decision makers and prejudice its NEPA analysis and conclusions. Examples of BLM's mischaracterizations include: • BLM "has limited ability to provide for meaningful or measurable mitigations actions in the context of cumulative climate change resulting from global emissions." • The BLM's decision space for mitigating climate impacts from fossil fuels development is currently limited by authorization in statutes such as FLPMA and the MLA. • No single authorized project level action can produce emissions with such significance that the action could be perceived as influencing the climate. However, all GHG emissions (big and small) contribute to changes in atmospheric radiative forcing and ultimately climate change	The BLM considers the comment non-substantive to the extent that it does not allege an error or material omission in the BLM's analysis or suggest new information for the BLM to consider. Generally, the BLM regulations at 43 C.F.R. §§ 3101.12, 3101.13, and 3162.51 authorize the agency to prescribe reasonable mitigation measures within its discretion and its technical judgment. The EA, Section 3.6.2.3, discusses mitigation strategies designed to reduce GHG emissions and incorporates by reference information from the 2022 ARTR as well as the 2022 Annual GHG Report. Analysis and approval of future development may include application of best management practices within BLM's authority, as COAs, to reduce or mitigate GHG emissions. Additional measures proposed at the project development stage also 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 Draft EA and the 2022 BLM Specialist Report Inadequately Analyze Compatibility of New Commitments of Federal Fossil Fuels with the U.S. Goal of Avoiding 1.5°C Warming. Neither the EA for the proposed lease sale nor the 2022 BLM Specialist Report adequately analyze whether the estimated GHG emissions associated with the proposed lease sales and the cumulative GHG emissions from the federal fossil fuel program are compatible with the U.S. goal of avoiding 1.5 C of warming. The United States is a signatory to the United Nations' Paris Agreement, which seeks to keep global temperatures within 2 C of the preindustrial climate, and preferably within 1.5 C. Among other pledges and commitments, the United States has pledged to reduce its emissions by filing an intended nationally determined contribution with the United Nations to reduce net GHG emissions by 17 percent below 2005 levels by 2020, and by 26-28 percent by 2025. However, BLM's NEPA analyses fail to analyze the compatibility of cumulative federal fossil fuel program emissions with the United States' commitments to avoid 1.5 C of warming. This is despite federal agencies, including the Bureau of Ocean Energy Management, which oversees offshore leasing, having conducted this type of analysis in the context of reviewing other federal projects pursuant to NEPA.	The requested analysis is included for informational purposes in Chapter 9 of the Annual GHG Report, which was incorporated by reference in the lease sale EA. See Section 3.6.2. This analysis includes information from the United Nations emissions gap report which shows the difference between global emissions pathways required to limit warming to 1.5 degrees Celsius (°C) or 2.0°C (i.e. carbon budgets) with the anticipated emissions based on national commitments to reduce GHG emissions. At this time, BLM has not developed a standard or emissions budget that it can apply uniformly to determine significance based solely on climate change or GHG emissions. Until the BLM develops tools to analyze the relative emissions impact of its activities nationwide, the BLM can only disclose GHG emissions and climate impacts and provide context and analysis for those emissions and impacts.
In the 2022 BLM Specialist Report section 9.4, "Goal Alignment", BLM states that "At present, the BLM's short-term projections of potential emissions from existing and near-term authorizations are consistent with the nation's net zero by 2050 goal and the shorter-term 2030 commitments made for the NDCs under the Paris Agreement. This is primarily due to a decline in projected production of oil, gas, and coal through mid-century (see Figure 7-1) from existing and foreseeable Federal fossil fuel leases and increases in Federal renewable energy right of ways (see Table 10-4). The longer-term estimates that include the modeled effects of the Inflation Reduction Act also show progress towards meeting national goals, such that the economy-wide influences of the law are likely to shape additional federal fossil fuel development in the years to come." However, as discussed elsewhere in these comments, BLM cannot use future predictions of GHG reductions based on the IRA to justify the authorization of GHG emissions now.	Existing CEQ guidance suggests comparing emissions to national goals. Throughout the analysis, the BLM does not rely on the IRA to lessen its disclosed impacts of GHG emissions; rather, it analyzes anticipated emissions of the parcels being considered for sale and cumulative emissions for the relevant planning area, in a variety of contexts. Figure 3.4, within the analysis, shows the projected short-term emissions reductions associated with the IRA. This figure is provided to show an additional scenario for what emissions could look like in the future. The IRA is just one scenario provided to provide the reader additional information regarding future emissions.
BLM failed to consider the production gap reports discussed above [Stockholm Environment Institute 2020 Production Gap Report; UN Production Gap Report, released in November 2023], which indicate an imperative to rapidly transition away from fossil fuels using supply side policies.	The BLM has considered the SEI report in light of the comment, but it did not alter the BLM's conclusions.

BLM continues to improperly frame and weigh the context and intensity factors for assessing the significance of reasonably foreseeable GHG emissions from the proposed lease sales and their cumulative climate impacts. Although BLM acknowledges that all GHGs contribute incrementally to the climate change phenomenon, BLM persists in comparing the estimated emissions associated with the proposed action to the total global, national, state, and other categories of GHG emissions to support its finding that the GHG emissions from the proposed actions are insignificant. BLM's attempt to minimize the estimated GHG emissions from the proposed actions in this way is precisely how the 2016 CEQ GHG Guidance and 2023 Interim CEQ Guidance directed federal agencies not to limit assessments of the significance of GHG emissions.97 Federal Courts, including, most recently, the Tenth Circuit, agree. See, e.g., *Diné CARE v. Haaland*, 59 F.4th at 1043-1044; see also 350 *Montana v. Haaland*, 50 F.4th 1254, 1266-1267 (9th Cir. 2022). This method of analysis doesn't reveal anything beyond the nature of the climate change challenge itself.	The BLM considers this comment non-substantive to the extent it seeks to interpret legal authorities that are the best evidence of their contents rather than alleging an error or material omission in the BLM's analysis or submitting new information for the BLM's consideration. The BLM analyzes potential impacts from climate change and GHGs in detail in the EA (see Sections 3.6.1 and 3.6.2). In the ARTR, the BLM quantifies direct, indirect, and cumulative emissions from the combustion of oil and gas and discusses the significance of these emissions. The BLM analyzes, in accordance with NEPA, the environmental impacts of leasing, including quantifying and forecasting aggregate GHG emissions from oil and gas development and addressing the environmental effects of downstream oil and gas use including the effects on climate change. As described in Section 3.6.2.2, to put the estimated GHG emissions for this lease sale in a relatable context, potential emissions that could result from development of the nominated lease parcels are compared with other common activities that generate GHG emissions and with emissions at the state and national level. To the extent that GHGs can influence changes in climates across various scales, the EA and the associated Specialist Report on GHGs have analyzed and disclosed those relationships. As detailed in the Annual GHG Report, the BLM also looked at other tools to inform its analysis, including the Model for the Assessment of Greenhouse Gas Induced Climate Change (MAGICC) model (see Chapter 9 of the Specialist Report). Refer to the FONSI for context and intensity factors for these issues.
Moreover, BLM's analysis of GHG emissions from the proposed lease sale in comparison with global, national, state, and other categories of emissions is incomplete and fails to inform the public and decision maker of comparisons that would more effectively reveal the context and intensity of the reasonably foreseeable GHG emissions. BLM correctly points out that GHGs have a long atmospheric lifetime, which allows them to become well mixed and uniformly distributed over the entirety of the Earth's surface, no matter their point of origin. Draft EA at 83. However, BLM's EA for the proposed lease sale never explains why this aspect of GHGs should limit BLM's comparison of potential emissions from the proposed actions to global, state, and national emission totals for purposes of providing context of their significance and potential contribution to climate change impacts. In other words, BLM never compares or offers a rational explanation for why it would be inappropriate to compare potential GHG emissions from one proposed lease sale to the potential GHG emissions from another past or present lease sale. Similarly, why not compare the potential GHG emissions from one proposed lease sale with another past or present federal (or non-federal) fossil fuel action or project? Why not compare the potential emissions to different individual sources of GHG emissions, such as a gas-fired power plant? A dairy operation? A landfill?	The BLM employs the methodologies best suited to its analysis. See *WildEarth Guardians v. Bernhardt*, 501 F. Supp. 3d 1192, 1209 (D.N.M. 2020) ("nothing in [NEPA's] text and nothing in its associated regulations specifically mandates that agencies perform a particular analysis or subscribe to a particular methodology. … NEPA requires that the agency assess the direct and indirect impact on the environment, and agencies have wide discretion in how to perform those tasks.").

BLM should conduct a social cost analysis of the cumulative GHG emissions attributable to all federal fossil fuel development and production, as well as of the GHG emissions attributable to the proposed sale(s) in accordance with the 2021 United States Government, Interagency Working Group (IWG) Social Cost of Greenhouse Gas estimates. In doing so, BLM should acknowledge the fact that the IWG has consistently indicated that these numbers represent an underestimate of the actual social costs associated with a given ton of GHG pollution. This fact has been borne out by the Environmental Protection Agency's September 2022 Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances, which reflects "recent advances in the scientific literature on climate change and its economic impacts and incorporate recommendations made by the National Academies of Science, Engineering, and Medicine." The fact that the EPA's social cost estimates, which are scientifically rigorous and reflect the best and most up-to-date scientific and economic data, are significantly higher than those of the IWG further illustrates the extent to which the IWG interim numbers may be considered an underestimate. Nonetheless, the IWG numbers represent the most current official estimate of social costs, and therefore constitute an important starting point for BLM's analysis, which must include a discussion of the ways in which the IWG estimates are likely to undervalue future climate damages.	Section 3.6.2.2 of the EA incorporates estimates of SC-GHG cited in the Environmental Protection Agency's Final Rule of March 8, 2024, 89 Fed. Reg. 16820, 17018-20, which constitute the best available science for purposes of Departmental decision-making and/or analysis.

BLM must take a hard look at the impacts of methane, preferably in both a programmatic NEPA review, and an aggregated EIS for the proposed 2024 sales as discussed above. Methane is an incredibly potent greenhouse gas. Methane has contributed to approximately 30% of the global rise in temperatures to date. 103 Because of methane's potent short-term warming characteristics, curbing methane emissions is one of the most effective near-term ways to address the climate crisis. Methane emissions from fossil fuel operations represent nearly one-third of human-caused emissions.104 These emissions represent both a major climate threat and also an opportunity. Slowing and ultimately halting fossil fuel demand will not by itself achieve needed GHG cuts, particularly in the near-term. This means that curbing wasteful methane emissions from oil and gas production are an essential element of reducing climate-warming emissions.	The BLM analyzes air impacts, including methane emissions, in Section 3.6 in both a general air quality context and a climate change context. In December of 2023, the EPA released a rule under the Clean Air Act (CAA) to reduce methane and other harmful air pollutants from new and existing oil and gas operations nationwide. The EPA's Rule will sharply reduce emissions of methane and other harmful air pollution from oil and natural gas operations — including, for the first time, from existing sources nationwide. The final action includes New Source Performance Standards (NSPS) to reduce methane and smog-forming volatile organic compounds from new, modified and reconstructed sources. It also includes Emissions Guidelines, which set procedures for states to follow as they develop plans to limit methane from existing sources. Specifically, the EPA Rule finalizes 40 C.F.R. § 60 Subpart OOOOb regulating GHGs (in the form of a limitation on emissions of methane) and VOCs emissions for the Crude Oil and Natural Gas source category pursuant to CAA section 111(b)(1)(B). Second, the EPA finalizes the presumptive standards in 40 C.F.R. § 60 Subpart OOOOc to limit GHGs emissions (in the form of methane limitations) from designated facilities in the Crude Oil and Natural Gas source category, as well as requirements under the CAA section 111(d) for states to follow in developing, submitting, and implementing state plans to establish performance standards. Third, the EPA finalizes several related actions stemming from the joint resolution of Congress, adopted on June 30, 2021, under the CRA, disapproving the previous 2020 Policy Rule. Fourth, the EPA finalizes a protocol under the general provisions of 40 C.F.R. § 60 for 40 CFR part 60 for Optical Gas Imaging to detect gas leaks from industrial sources. Additionally, oil and gas operations in New Mexico are subject to New Mexico's Natural Gas Capture Requirements (Waste Prevention Rule), NMAC 19.15.27, and the "Oil and Natural Gas Regulation for Ozone Precursors" rule, NMAC 20.2.50.1, including emissions reduction requirements for compressors, engines and turbines, liquids unloading, dehydrators, heaters, pneumatics, storage tanks, and pipeline inspection gauge launching and receiving. The regulation also encourages operators to stop venting and flaring and use fuel cells technology to convert CH4 to electricity at the well site and incentivizes new technology for leak detection and repair. Approximately 50,000 wells and associated equipment will be subject to this regulation. It is anticipated that the regulation will annually reduce VOC emissions by 106,420 tons, NOX emissions by 23,148 tons, and methane (CH4) emissions by 200,000 to 425,000 tons statewide. Analysis and approval of future development may include application of BMPs within BLM's authority, as COAs or lease stipulations, to reduce or mitigate GHG emissions. Additional measures proposed at the project development stage also 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.
While Commenters understand that BLM has undertaken a rulemaking on methane waste, as discussed in Section D.4, supra, and while this is necessary regulatory action, BLM should not be issuing additional leases until it takes affirmative steps to address waste on Tribal and federal lands. At a minimum, as discussed supra, BLM must adequately address the impacts of methane waste from these sales both individually and collectively, and identify pathways to mitigate both the emission of methane and its impacts.	The BLM's 2024 Waste Prevention Rule, discussed in the context of socioeconomic impacts, has been considered in the EA (see section 3.6.2).

And BLM summarizes some of its obligations to analyze disproportionately high and adverse human health effects on "minority" and "low-income populations" under Executive Order 12898, along with CEQ and EPA Guidance on environmental justice and BLM's own recent Instruction Memorandum IM 2022-059. Draft EA at 60. However, the agency fails to take NEPA's requisite hard look at the reasonably foreseeable future health and safety impacts that could result from this sale, including disproportionate and adverse impacts to "environmental justice" populations. As stated above, BLM cannot defer its analysis of health impacts to the leasing stage. And in proceeding to dismiss health and environmental justice impacts as insignificant, despite acknowledging the potential for increased, disproportionate, and adverse health risks and impacts, BLM fails to articulate a rational connection between the facts found and the choices made, rendering its decision to issue a FONSI and authorize this lease sale arbitrary and capricious.	The BLM considers this comment non-substantive to the extent that it seeks to interpret legal authorities that are the best evidence of their contents rather than alleging a specific error or material omission in the BLM's analysis or suggesting new information for the BLM to consider. The BLM has conducted an extensive analysis of human health impacts, including air quality impacts, in the EA. Because the BLM cannot know until the APD stage exactly where development will occur relative to human presence, and because some impacts such as emissions are highly variable depending on distance, some site-specific analysis and mitigation must necessarily occur at that later stage of development in order to best protect human health.
An extensive and ever-growing body of peer-reviewed research has shown what people living near oil and gas operations already know firsthand—that proximity to drilling and fracking operations and other oil and gas facilities is linked to adverse health risks and impacts. These risks and impacts are discussed in further detail throughout this section, and in the numerous accompanying exhibits, but in general, they include (but are not limited to): • Reproductive harms – including birth defects, low birth weight, preterm births, and miscarriages; • Respiratory health effects – including asthma, lung disease, breathing difficulty, and, most recently, increased vulnerability to COVID-19; • Eye, skin, and throat irritation and rashes; • Cardiovascular effects – including higher blood pressure and other indicators of, or precursors to, heart disease; • Possible disruption of the endocrine system (a system of glands producing hormones that regulate a variety of functions in the body, including metabolism, growth and development, reproduction, sleep, and mood); • Cancer (lung cancer and other types of cancer); Motor vehicle injuries and fatalities, and other health and safety risks associated with increased vehicle traffic (and the air pollutants it emits) from oil and gas development; • Injuries and fatalities from explosions, fires, spills, and leaks; and • Trauma and psychological stress.	The comment does not provide information that the BLM has not already analyzed and discussed in the EA.

One excellent, frequently updated, and easy-to-use resource for keeping up with this growing body of peer-reviewed research is the Physicians, Scientists, and Engineers for Healthy Energy ("PSE Healthy Energy") database, the Repository for Oil and Gas Energy Research, or "ROGER."129 ROGER is an extensive repository of peer-reviewed literature, "a near-exhaustive collection of bibliographic information, abstracts, and links to many of [sic] journal articles that pertain to shale and tight gas development."130 This database is organized into several categories, and for the "Health" category alone, there are over 260 studies listed, including several recent studies from 2019-2022. BLM should avail itself of this invaluable resource in order to take NEPA's requisite hard look at health impacts.	The BLM appreciates commenter's suggestion and will continue to monitor publicly available sources and will incorporate scientific sources as they are published.
There are several other notable scientific papers BLM should consider in order to analyze and disclose to the public the health risks and impacts associated with its leasing decisions. Multiple peer-reviewed papers have identified adverse health effects and risks arising from exposure to unconventional oil and gas drilling operations, even within a large radius of residences—potentially up to ten miles. For example, one study found that babies whose parents lived in close proximity to multiple oil and gas wells were 30% more likely to be born with heart defects than babies born to parents who did not live close to oil and gas wells. Other adverse health impacts documented among residents living near drilling and fracking operations include increased reproductive harms, asthma attacks, higher rates of hospitalization, ambulance runs, emergency room visits, self-reported respiratory problems and rashes, motor vehicle fatalities, trauma, and drug abuse. Moreover, one recent study found that fracking and drilling near people's homes "drives stress experiences that go beyond the mere presence of industrial land uses in neighborhoods," and identified two key institutional barriers driving negative mental health impacts for people living near UOG [unconventional oil and gas] production – namely: 1) uncertainty, due to inaccessible, transparent information about environmental and public health risks and 2) powerlessness to meaningfully impact regulatory or zoning processes. In turn, "these institutional barriers make UOG production a chronic stressor – which can be more insidious, negative, and, significantly, can generate longer- term mental health impacts such as self-reported depression."	The BLM has reviewed and considered the studies listed by the commenter regarding the potential risks to human health. The studies do not contradict BLM's analysis or conclusions. They do not present any additional risk factors or provide additional impact indicators that are not already considered. Therefore, the BLM has concluded that the risks are adequately evaluated in the analysis as described above and further in the 2022 Air Resources Technical Report. The BLM will continue to monitor publicly available sources and will incorporate scientific sources as they are published.

A 2023 review of literature on health impacts of fracking by Physicians for Social Responsibility ("PSR") concluded that: In sum, the vast body of scientific studies now published on hydraulic fracturing in the peer-reviewed scientific literature confirms that the climate and public health risks from fracking are real and the range of environmental harms wide. Our examination uncovered no evidence that fracking can be practiced in a manner that does not threaten human health directly or without imperiling climate stability upon which human health depends. The rapidly expanding body of evidence compiled here is massive, troubling, and cries out for decisive action. Across a wide range of parameters, the data continue to reveal a plethora of recurring problems that cannot be sufficiently averted through regulatory frameworks. The risks and harms of fracking are inherent in its operation. The only method of mitigating its grave threats to public health and the climate is a complete and comprehensive ban on fracking. Indeed, a fracking phase-out is a requirement of any meaningful plan to prevent catastrophic climate change.	The BLM identified, discussed, and analyzed the potential impacts to groundwater quality and quantity in AIB-1 and Section 3.6.3, and potential impacts to human health and safety in AIB-19 of the EA. Cumulative effects on groundwater resources and human health and safety are also analyzed and discussed in these sections. Additionally, the BLM further analyzes the risk of spills, casing failures, and groundwater contamination in the 2023 BLM Water Support Document for Oil and Gas Development in New Mexico (BLM 2023c). Human Health and Safety is analyzed in AIB-19 of the EA. As stated in the EA, 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. As stated in EA Section 1.4.2, purchasers of oil and gas leases are required to comply with all applicable federal, state, and local laws and regulations, including obtaining all necessary permits prior to any lease development activities. This includes, but is not limited to, BLM and state regulations regarding hydraulic fracturing, including casing specifications, monitoring and recording, and management of recovered fluids. The BLM is also required to comply with all applicable federal, state, and local laws and regulations, as well as Department of Interior policies when leasing mineral estate and responding to EOIs. The adequacy of applicable laws and regulations is outside the scope of the BLM decision being reviewed.

"No Surface Occupancy" (NSO) stipulations could be implemented within a certain distance of residences, schools, or other occupied areas that might mitigate some of these effects, but they do not eliminate BLM's obligation to take a hard look at health effects at the leasing stage, as NEPA requires. Stipulations and notices are used to comply with FLPMA and the MLA, and are not a substitute for a NEPA analysis. See, e.g., 43 C.F.R. § 3101.1-3; 43 U.S.C. § 1732(a). Moreover, most existing oil and gas setbacks or NSO stipulations (typically < 1000 feet) are likely inadequate to protect people and communities against health and safety risks and adverse effects. At minimum, some health experts have called for a one-mile minimum distance between drilling facilities and schools, hospitals, and occupied dwellings, in light of the heightened health risks of residing within close proximity to unconventional oil and gas drilling sites.137 Many others call for setbacks of even greater distances. One study found adverse health impacts at distances of six miles.138 Another study found increased risk of congenital heart and neural tube defects in babies born to mothers living within 10 miles of natural gas wells.139 Even larger setbacks may not protect against certain health hazards, especially for people already facing disproportionate health risks due to cumulative social, structural, and environmental factors, or for children and the elderly. For example, a 2016 study and Health Impact Assessment ("HIA") in Maryland's Marcellus Shale Basin found that, even with a setback of 2000 feet from residential property as a "mitigating factor," Air Quality was a fracking-related hazard of High concern for its potential negative health impacts after taking into account additional evaluation criteria, such as presence of vulnerable populations, duration and frequency of exposure, and likelihood and severity/magnitude of health effects.140 BLM must take a hard look at the adverse health risks and effects associated with proximity to oil and gas activity and facilities and disclose them to the public. We appreciate BLM's acknowledgment of adverse health risks and effects associated with living within 1.25 miles of oil and gas wells, and the agency's general acknowledgment of the potential for amplified, adverse and disproportionate effects to certain populations or individuals. See, e.g., Draft EA at 52. However, having acknowledged these risks and effects, and the presence of residences and populations who might experience them, BLM must take the next step and apply these findings to its decision-making, and articulate a rational connection between the facts found and the choice made to authorize the lease sales.	The BLM has reviewed and considered the studies listed by the commenter regarding the potential risks to human health. The studies do not contradict BLM's analysis or conclusions. They do not present any additional risk factors or provide additional impact indicators that are not already considered. Therefore, the BLM has concluded that the risks are adequately evaluated in the analysis as described above and further in the 2022 Air Resources Technical Report. The BLM will continue to monitor publicly available sources and will incorporate scientific sources as they are published.

BLM must take a hard look not only at direct health impacts and proximity-related health impacts of oil and gas development, but also at cumulative health risks and impacts. See 40 C.F.R. § 1508.1(g)(3). Cumulative health risks and impacts can arise not only from multiple pollutant exposures, and cumulative pollution exposures over time, but also from compounding structural, social, and economic factors, many of which are rooted in systemic inequities and injustices. Researchers have begun to apply a growing body of evidence documenting how social and environmental stressors lead to health inequities and cumulative impacts specifically in the oil and gas drilling context. For example, the aforementioned 2016 Marcellus Shale study and Health Impact Assessment ("HIA") ranked "social determinants of health," (in this study, social determinants included crime, injuries, mental health, sexually transmitted infections, and substance abuse) as a fracking-related hazard of the highest concern with respect to public health impacts, along with air quality and health care infrastructure. Cumulative risks, too, were considered their own category of fracking-related public health hazard, and ranked as a "moderately high" concern (along with water quality, noise, and traffic).	The BLM has reviewed and considered the study referenced by the commenter regarding the potential risks to human health. The study does not contradict BLM's analysis or conclusions. Therefore, the BLM has concluded that the risks are adequately evaluated in the analysis as described above and further in the 2022 Air Resources Technical Report. The BLM will continue to monitor publicly available sources and will incorporate scientific sources as they are published. Refer to EA Sections AIB-19 (HH&S), AIB-22 (EJ). Also see sections 3.6.1 and 3.6.2 for the BLM's air quality and climate analyses, which also consider human health.

However, we urge BLM to consider, and disclose to the public directly in its NEPA documents, additional context for EPA's risk ranges, even as there is no singular "safe" threshold for HAPs. For example, with respect to the benzene NESHAPs, which set up a two-step risk-based decision framework, the 100-in-1-million upper limit of "acceptable" lifetime cancer risk applies to the "most exposed person." BLM should make clear to the public what, if anything, it has done to ensure that its modeling accounts for the "most exposed person." In addition, satisfying the "100-in-1-million" upper limit for "acceptable" lifetime cancer risk to the most exposed person does not end the inquiry. As EPA notes, "The EPA will generally presume that if the risk to that individual [the Maximum Individual Risk] is no higher than approximately 1 in 10 thousand, that risk level is considered acceptable and EPA then considers the other health and risk factors to complete an overall judgment on acceptability."151 (emphasis added). While BLM acknowledges that there are populations who could experience increased risks associated with HAPs exposure based on Headwaters Economics data generally/at the county levels, Draft EA at 63, the agency should take the next step and discuss how this informs a determination of significance and articulate a rational connection between the facts found and the leasing decisions made. Ultimately, as with cumulative GHG emissions and climate change and with criteria pollutant emissions, we also emphasize that NEPA, FLPMA, the APA, and applicable regulations require BLM to go beyond disclosing additional information about HAPs, even as we appreciate that additional information —BLM must ensure that the additional information informs its decision-making, and articulate a rational connection between the facts found and the choices made. This is particularly important given the potential for cancer risks to "the most exposed.	Additional context for EPA's AirToxScreen risk values is provided in the 2022 ARTR, which is incorporated by reference into the EA, and in the BLM Cumulative Hazardous Air Pollutants Modeling - Final Report referenced in the EA. Section 3.6.1.1. of the EA explains how the BLM used EPA's acceptable risk levels to determine the significance of HAP emissions. The level of environmental analysis conducted by the BLM for the Lease Sale is consistent with the purpose and requirements of NEPA.

BLM also cannot dismiss cumulative health impacts as temporary, and thus avoid taking a hard look at cumulative impacts, by simply assuming that wells will be properly plugged and reclaimed at the end of their useful lives, and thus cease to cause health risks and impacts at that time. For one, a well's time in production can span decades. BLM must analyze cumulative emissions and their impacts over the full life course of a well, in conjunction with other wells in the lease sale area and other past, present, and reasonably foreseeable future actions and emissions. Moreover, information from several states, and nationally, indicates that wells often are not properly plugged and reclaimed at the end of their "useful lives." For example, while it is sometimes difficult to obtain an exact count of "orphaned" or improperly plugged and abandoned wells, reports indicate that there are hundreds, even thousands, of such wells across private, state, and federal lands in Western states such as Colorado, New Mexico, and Wyoming. These wells can leach toxic chemicals and contaminate water supplies, posing direct and cumulative health risks to nearby communities. State and BLM bonding requirements are usually insufficient to meet the costs associated with plugging and abandoning these wells, retiring other equipment, and cleaning up the well sites. Thus, idle or orphaned wells and abandoned well sites pose not only health risks and impacts, but also financial ones, which can further compound existing health impacts, including cumulative impacts, and related health inequities.	The decision under review is "whether to make available for lease the nominated lease parcels with or without constraints, in the form of lease stipulations, as provided for in the approved land use plan." See EA Section 1.3. The BLM enforces rigorous plugging and abandonment requirements for wells that have reached the end of their production, although those requirements are outside the scope of the decision. Additionally, 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) can remove GHGs from the atmosphere or reduce emissions in other areas. Chapter 10 of the Annual GHG Report provides a detailed discussion of GHG mitigation strategies.
The inequities at which BLM must take a hard look in an environmental justice analysis are not incidental, nor are they biologically determined—they are structural, systemic, and part of an unjust historical and ongoing pattern and practice of environmental racism, settler colonialism, and treatment of communities in the leasing areas as energy sacrifice zones. And, as discussed throughout these comments, there are several other health risks and impacts BLM should also analyze in the context of health and environmental justice, particularly in light of social and structural factors that affect health. BLM must engage in a thorough analysis of these and other inequities that NEPA requires, apply this analysis to its decision-making, and articulate a "rational connection between the facts found and the choices made" in coming to its ultimate conclusions in light of that analysis. *Motor Vehicle Mfr. Ass'n v. State Farm Mut. Auto. Ins. Co*., 463 U.S. 29, 43, 52 (1983). In conducting this analysis, BLM can and should synthesize existing local health, socioeconomic, and other data in the lease sale areas—for example, county health statistics and reports, locally-conducted health impact assessments,163 where available, or mapping of pollution exposure risks and demographic data through tools like U.S. EPA's "EJ Screen" or the Climate and Economic Justice Screening Tool165 —and the best available science, including but not limited to the peer-reviewed studies and sources mentioned in these comments.	The BLM employs the methodologies best suited to its analysis. See *WildEarth Guardians v. Bernhardt*, 501 F. Supp. 3d 1192, 1209 (D.N.M. 2020) ("nothing in [NEPA's] text and nothing in its associated regulations specifically mandates that agencies perform a particular analysis or subscribe to a particular methodology. … NEPA requires that the agency assess the direct and indirect impact on the environment, and agencies have wide discretion in how to perform those tasks."). The tools mentioned are among many tools that the BLM has the option to use, but in this instance, other data was used to evaluate the effects on environmental justice communities (US Census Bureau). There is currently no specific guidance on requiring the use of these particular tools for evaluating impacts in NEPA documents. Therefore, the BLM's determination to not use the cited screening tools at this time is within the agency's discretion.

Indeed, in Sandoval County, 30% of residents did not have a primary care provider, according to the latest available dataset from the NM Department of Health.180 Ozone is a criteria pollutant of particular concern that contributes to asthma and missed school days (and one that can, in general, adversely affect health, especially for "sensitive groups" such as children, the elderly, and those with pre-existing health issues). Background concentrations of ozone in some of the lease sale areas are already at or exceed the National Ambient Air Quality Standards ("NAAQS"), leaving virtually no room for growth in emissions. Several studies that measured and/or modeled gas-related air emissions in various states have identified significant increases in ground level ozone as a result of natural gas development.181 Ozone was once a summertime urban phenomenon but is now being seen increasingly in western rural areas during the winter due to the natural gas boom, so much so that some relatively small cities are no longer in compliance with the federal regulations that set allowable ozone levels.182 This is insufficient to comply with NEPA's requirements. BLM must go further and address how the proposed sale is consistent with meeting NAAQS requirements, as well as addressing the health and environmental impacts of such exceedances as are already occurring and those that are likely to occur or be exacerbated by the proposed action.	Ozone emissions are analyzed extensively in the EA including in AIB-19 (Human Health and Safety) and, most extensively, in the air quality analysis at Section 3.6.1. In addition to federal limits, oil and gas operations in New Mexico are subject to New Mexico's Natural Gas Capture Requirements (Waste Prevention Rule), NMAC 19.15.27, and the "Oil and Natural Gas Regulation for Ozone Precursors" rule, NMAC 20.2.50.1, including emissions reduction requirements for compressors, engines and turbines, liquids unloading, dehydrators, heaters, pneumatics, storage tanks, and pipeline inspection gauge launching and receiving. The regulation also encourages operators to stop venting and flaring and use fuel cells technology to convert CH4 to electricity at the well site and incentivizes new technology for leak detection and repair. Approximately 50,000 wells and associated equipment will be subject to this regulation. It is anticipated that the regulation will annually reduce VOC emissions by 106,420 tons, NOX emissions by 23,148 tons, and methane (CH4) emissions by 200,000 to 425,000 tons statewide. The FFO does not have a wintertime ozone issue. Wintertime ozone occurs in areas where strong temperature inversions trap pollutants at the surface, usually as the result of terrain and snow accumulation, among other factors. Future year modeling of ozone in the area completed by the BLM shows no exceedance of the ozone NAAQS in circa year 2032 (see section 3.6.1). Analysis and approval of future development may include application of BMPs within BLM's authority, as COAs or lease stipulations, to reduce or mitigate emissions. Additional measures proposed at the project development stage also may be incorporated as applicant-committed measures by the project proponent or added to necessary air quality permits.
With respect to water quality and quantity and health impacts, in addition to the considerations discussed infra, BLM should also consider how its authorization of this lease sale and reasonably foreseeable development of the leases could exacerbate water quality-related health impacts associated with PFAS contamination. For example, a new report by Physicians for Social Responsibility (PSR) reveals the staggering amount of these health-harming "forever chemicals" known to be used in oil and gas operations in New Mexico—not to mention additional PFAS chemicals that are likely present but not disclosed due to trade secret protections. BLM should take this report and the concerns it raises into account in its analysis and decision-making with respect to health impacts and potential impacts to groundwater and drinking water from PFAS "forever chemicals" used in oil and gas drilling and fracking.	Section AIB-1 (Groundwater Quality) and AIB-19 (Human Health and Safety) include information on PFAS.

Numerous studies also suggest that higher parental exposure to fracking and drilling during pregnancy can increase the incidence of high-risk pregnancies, premature births, low-birthweight babies, and birth defects.193 A study of more than 1.1 million births in Pennsylvania found evidence of a greater incidence of low-birth-weight babies and significant declines in average birth weight for babies born to people living within 3 kilometers of fracking sites.194 The study estimated that about 29,000 U.S. births each year occur within 1 kilometer of an active fracking site and "that these births therefore may be at higher risk of poor birth outcomes." A study of 9,384 pregnant people in Pennsylvania found that those who live near active drilling and fracking sites had a 40 percent increased risk for having premature birth and a 30 percent increased risk for having high-risk pregnancies.195 Another Pennsylvania study found that pregnant people who had greater exposure to gas wells—measured in terms of proximity and density of wells—had a much higher risk of having low-birthweight babies; the researchers identified air pollution as the likely route of exposure.196 In rural Colorado, parents with greater exposure to natural gas wells had a higher risk of having babies with congenital heart defects and possibly neural tube defects.197 A July 2020 study found that residential proximity to flaring (the open combustion of natural gas) from oil and gas development was associated with an increased risk of preterm birth, specifically for "Hispanic women," in the Eagle Ford Shale of Texas.198 Here, again, these documented risks are of particular concern in certain communities near the proposed lease sales in light of environmental justice concerns, like proximity of homes to multiple wells199 (an exacerbating factor in the Eagle Ford Shale study), and social and structural inequities, such as limited access to prenatal care.200 BLM should have taken local health data like this into account as part of its "hard look" at health impacts, especially as they relate to social determinants of health and environmental justice.	The BLM's analysis discloses the potential for adverse direct, indirect, and cumulative health impacts from the Proposed Action, including environmental justice communities. See EA AIB-19 and AIB-22. See also Section 3.6.1 and 3.6.2 for the BLM's air quality and climate analyses, which also consider human health. The EA describes the relevant social determinants of risk for affected communities and discusses how air pollutants associated with oil and gas activities can cause health effects, including but not limited to, compromises to immune and reproductive systems, birth defects, and developmental disorders. Additional information regarding the human health and safety effects of air quality and climate change can be found in the ARTR and the Annual GHG Report, respectively, which are incorporated by reference in the EA.

Those living near oil and gas development aren't the only ones at risk. Oil and gas workers also suffer high risks from toxic exposure and accidents. One study of the occupational inhalation risks caused by emissions from chemical storage tanks associated with fracking wells found that chemicals used in 12.4 percent of wells posed acute non-cancer risks, chemicals used in 7.5 percent of wells posed acute cancer risks, and chemicals used in 5.8 percent of wells posed chronic cancer risks.202 As summarized below: Drilling and fracking jobs are among the most dangerous jobs in the nation with a fatality rate that is four to seven times the national average. Irregularities in reporting practices mean that counts of on-the-job fatalities among oil and gas workers are likely underestimates…Occupational hazards in the fracking industry include head injuries, traffic accidents, blunt trauma, burns, inhalation of hydrocarbon vapors, toxic chemical exposures, heat exhaustion, dehydration, and sleep deprivation. An investigation of occupational exposures found high levels of benzene in the urine of wellpad workers, especially those in close proximity to flowback fluid coming up from wells following fracturing activities. Exposure to silica dust, which is definitively linked to silicosis and lung cancer, was singled out by the National Institute for Occupational Safety and Health as a particular threat to workers in fracking operations where silica sand is used. At the same time, research shows that many gas field workers, despite these serious occupational hazards, are uninsured or underinsured and lack access to basic medical care.[203] In addition, many oilfield workers may lack basic social and economic safety nets and lack support from their employer in mitigating risks and addressing harms such as those mentioned above. A recent survey of current and former oilfield workers in New Mexico's Permian Basin revealed that, there, about 57 percent of workers surveyed were not provided health insurance by their employer.204 Just 21 percent got retirement benefits and 78 percent did not have access to unemployment, yet 69% reported being laid off or having their hours cut during dips in the volatile market.205 Almost half of respondents (46%) said they had an accident on the job.206 BLM should take information like this into account in its NEPA analysis of health risks and impacts, socioeconomics, and environmental justice, and in particular, should factor information like this into its consideration of any purported socioeconomic benefits of oil and gas development to individuals or communities associated with the proposed lease sale.	Human Health and Safety is analyzed in AIB-19 of the EA. As stated in the EA, 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. This includes, but is not limited to, worker safety laws as stipulated by the Occupational Safety and Health Administration.

Radioactive wastes from oil and gas production can be found in produced water, flowback water from hydraulic fracturing, drilling waste including cuttings and mud, and/or sludge. This material can concentrate in pipes, storage tanks and facilities, and on other extraction equipment, and may be left on site or be emitted into the environment. Some of these materials, such as Radium, can penetrate the skin and raise the risk of cancer.207 The NEPA analysis conducted here must consider the potential health impacts of radioactive materials, as well as all other potential health effects discussed herein. Processes used to produce oil and gas often generate radioactive waste containing concentrations of naturally occurring radioactive materials (NORM) and Technologically Enhanced Naturally Occurring Radioactive Materials (TENORMS). The geological formations to be drilled will result in radioactive waste, containing both NORMS and TENORMs. The radioactive materials will show up in formation drilling, production wastes, and operations. Every single shale well that uses an on-site pit for disposal of drill cuttings and/or fluids likely will leave behind some amount of concentrated radioactive materials.208 Further, Alpha-emitting radioactive decay elements concentrate at the pipe scale, so the waste is much more radioactive than any of the constituent parts.209 BLM must also evaluate radiation exposure risks as part of its obligation to take a hard look at public health and safety. Further, BLM should conduct a baseline groundwater analysis in the lease sale areas before any more leasing and development occurs, to ensure that no environmental contamination occurs from disposal of radioactive sludge/scale.	Potential impacts to human health and safety from radioactive materials are discussed in AIB-19 and Appendix D of the EA. The analysis discusses the risk of exposure to radioactive materials, how NORM can be brought to the surface in drill cuttings and produced water, as well as the state's regulatory program to safely manage the disposal of drill cuttings and produced water.

The BLM must provide a detailed account of all regional groundwater resources that could be impacted, including usable aquifers that may not currently be used as a drinking water supply. The accounting must include, at minimum, all aquifers with up to 10,000 parts per million total dissolved solids, and it cannot substitute existing drinking water wells or any other incomplete proxy for a full description of all usable or potentially usable groundwater in the region. Second, BLM must use that accounting to assess how new oil and gas wells might impact these resources. That evaluation must assess the sufficiency of protective measures that will be employed, including wellbore casing and cementing and vertical separation between aquifers and the oil and gas formations likely to be hydraulically fractured. In assessing these protections, BLM cannot presume that state and federal regulations will protect groundwater, because of the shortcomings and industry noncompliance described above. BLM may not defer this analysis of groundwater impacts to the APD stage. *WildEarth Guardians*, 457 F. Supp. 3d at 888. Failure to conduct this analysis violates NEPA.	The BLM has analyzed water sources that could potentially be impacted by development from the proposed lease sale (see AIB-1, AIB-2 and Section 3.6.3). Because the BLM cannot know until the APD stage exactly where development will occur relative to groundwater, some site-specific analysis and mitigation must necessarily occur at that later stage of development to best protect groundwater supplies.
BLM has failed to fully evaluate the reasonably foreseeable impacts to big game from development on the proposed leases. This extends beyond a description of: (a) the regulatory and management frameworks applicable to big game species, along with the scientific literature, (b) existing conditions, and which lease parcels are in different categories of habitat (such as crucial winter habitat and migration corridors), (c) the lease stipulations that would apply, and (d) how BLM selected which parcels in big game habitat to offer or defer – none of which BLM has done in this Draft EA. Such information would provide a basis for analyzing the likely impacts to big game from development on the proposed leases—but it would not substitute for that analysis.227 BLM's failure to analyze the likely impacts to big game populations from the leases it proposes to offer and boilerplate statements about categories of impacts violates NEPA. BLM instead must analyze the site-specific, direct, indirect, and cumulative impacts of leasing the parcels on the biology, ecology, reproduction, migration, connectivity, and viability of individual herds and entire populations of pronghorn, mule deer, and other big game species. This must be done for the proposed parcels in connection with parcels sold in other, past federal and non-federal oil and gas lease sales and developments.	The EA addresses impacts to wildlife and game species in AIB-13, including stipulations and COAs. Additionally, none of the nominated lease sale parcels are within known mapped migration corridors, therefore, attaching stipulations related to big-game corridors to the parcels is not warranted at this time. As stated in AIB-13 of the EA, pre-disturbance surveys would be required at the time of proposed lease development in accordance with STCs of the lease. The surveys would analyze potential effects on game and non-game species habitat. Avoidance, minimization, and/or mitigation measures would also be determined at that time. The BLM has the authority under standard terms and conditions to attach COAs at the site-specific level to minimize significant adverse effects on resource values at the time operations are proposed.

BLM improperly limited the context and scope of the potentially affected environment in which the proposed leasing actions, and their cumulative impacts, will occur. Significance assessments under NEPA require consideration of "context," meaning the significance of the proposed action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality.[225] Significance varies with the setting of the proposed action.[226] Despite these requirements for considering the context of the proposed lease sale and despite the global nature and impacts of cumulative GHG emissions and climate change, BLM's Draft EA limits the consideration of context to the localities wherein the oil and gas development would take place, if authorized, and finds that the impacts of oil and gas development would not have international, nation, regional, or state-wide importance. We request BLM consider a wide array of contexts, including society as whole, global, national, and regional contexts, that reflect the cumulative and global nature of climate change impacts.	The BLM provided a wide range of potential impact contexts in the Annual GHG Report, which was incorporated by reference into the EA. The Specialist Report presents the life-cycle representation of federal onshore mineral estate GHG emissions relative to various local, state, national, and global emissions and impact contexts. The BLM analyzes the impacts associated with the alternatives using the best available information, which is typically not monetized estimates of benefits or costs. Even so, the BLM also estimates the social cost of GHGs (SC-GHG) to provide additional context for decision making. At this time, BLM has not developed a standard or emissions budget that it can apply uniformly to make a determination of significance based on climate change, GHG emissions, or the SC-GHG. Until the BLM develops tools to analyze the relative emissions impact of its activities nationwide, the BLM can disclose GHG emissions and climate impacts, and provide context and analysis for those emissions and impacts; the BLM cannot determine significance for a proposed action based on GHG emissions or climate impacts alone. Additionally, the BLM provided a wide range of potential impact contexts in the Annual GHG Report, which was incorporated by reference into each analysis. The Annual GHG Report presents the life-cycle representation of the federal onshore mineral estate GHG emissions relative to various state, national and global emissions, and context of impacts.
BLM's omission of the intensity factor of controversy in the Draft EA is improper. As the global body of scientific research and understanding of climate change reflects, there is controversy concerning critical aspects of the nature and effect of GHG emissions and their impact on climate change. This controversy is exemplified by the BLM's conclusions that the emissions from the proposed lease sales and the cumulative emissions from the federal fossil fuel program are not significant as compared to a robust scientific literature, indicating current and foreseeable fossil fuel development is not aligned with the GHG reductions necessary to prevent warming exceeding 1.5°C.350 We request BLM address the NEPA intensity factor for controversy and do so for all of the 2024 lease sales in a single EIS.	There is no significant scientific controversy as to whether or not anthropogenic GHGs contribute to climate change resulting in adverse impacts to the environment, which is why the BLM developed the Annual GHG Report. Climate impacts are among many factors that are considered in the NEPA analysis to evaluate the significance of a proposed action and the BLM's exercise of its discretion in deciding on leasing actions. In addition, the lease sales are distinct actions that do not necessarily implicate the same intensity factors. Refer to the FONSI for context and intensity factors used.
BLM also fails to adequately indicate how the lease action will violate federal or state law and policy, but there are several federal and state government laws and policies that set GHG emission reduction targets or commitments, which authorization of the proposed leases will likely threaten. On the federal side, President Biden announced a goal to achieve net-zero emissions by 2050,351 as well as a target to reduce GHG emissions by 50-52% by 2030, compared to 2005 levels.352 In addition, the United States is a signatory to the 2015 Paris Agreement, committing to a goal of limiting global temperature increase well below 2 C, pursuing efforts to limit the increase to 1.5 C, and committing to reaching global peaking of GHGs as soon as possible.	The leasing action will not violate any laws or policies. Instead, the BLM makes federal mineral resources, such as oil and gas, available for development in accordance with laws including the MLA and FLPMA. See EA Sections 1.2 and 1.4 for information regarding the BLM's requirements under the MLA, FLPMA, and other statutes and regulations. As stated in EA Section 1.4.2, purchasers of oil and gas leases are also required to comply with all applicable federal, state, and local laws and regulations. Chapter 2 of the Annual GHG Report, incorporated in the EA by reference, discusses the relationship between BLM's coal, oil, and gas leasing programs with other laws and policies at the federal and state level.

BLM must ask FWS whether any listed or proposed species may be present in the area of the agency action. 16 U.S.C. § 1536(c)(1); 50 C.F.R. § 402.12. If listed or proposed species may be present, BLM must prepare a "biological assessment" to determine whether the listed species may be affected by the proposed action. The biological assessment must generally be completed within 180 days. 16 U.S.C. 1536(c)(1); 50 C.F.R. § 402.12(i). The threshold for a "may affect" determination and the required Section 7(a)(2) consultation is low so as to ensure that listed species are not jeopardized. *Karuk Tribe of Cal. V. U.S. Forest Serv.*, 681 F.3d 1006, 1027 (9th Cir. 2012).	The BLM considers this comment non-substantive to the extent that it seeks to interpret legal authorities that are the best evidence of their contents, rather than alleging a specific error or material omission in the BLM's analysis or contributing new information for the BLM to consider. Generally, Section 4.1 of the EA discusses how the Proposed Action would comply with threatened and endangered species management guidelines outlined in applicable RMPs and the Biological Assessment, as well as FLPMA, NEPA, and ESA Section 7 consultation requirements. In addition, as described in AIB-7, Threatened and Endangered Species, the BLM continues to review the available climate science in connection with its statutory responsibilities, including under NEPA.
BLM should have provided translations into Navajo, Pueblo, and Spanish speaking languages.	BLM has not provided translation of their lease sales to Navajo, Pueblo, & Spanish speaking communities.
The public comment period for this action - one month- is too short to allow meaningful input. In rural areas and on tribal lands in particular, it is essential to allow ample time for all stakeholders to access all avenues available for public comment. One month over the holidays is not enough time or opportunity to gather meaningful input from everyone. Moreover, this is a time when Pueblos and Navajo Nation are particularly busy with ceremonies and leadership transitions. A significant reason that these lease sales have been deferred since 2019 is concerns raised by tribal leaders during the initial consultation process.	Public involvement opportunities are detailed in Sections 1.5.2-1.5.4 of this EA. In accordance with 43 C.F.R. § 3120.42, *Posting timeframes*, the BLM made the revised draft NEPA available for review from December 10, 2024, through January 9, 2025. Conducted consultation is detailed within EA sections 4.2 and 4.3.