Doe Run Company Lease Modifications MOBLMA 046975, MOBLMA 047477, MOBLMA 079252

DRAFT Environmental Assessment

September 2022

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Abbreviations and Acronyms

AADT	average annual daily traffic
bgs	below ground surface
BLM	Bureau of Land Management
BMP	best management practice
CBG	census block group
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CR	county road
CWA	Clean Water Act
dB	decibel
dBA	A-weighted decibel
DOI	U.S. Department of the Interior
EA	Environmental Assessment
EIQ	emissions inventory questionnaire
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
GHG	greenhouse gas
IPaC	Information for Planning and Consultation
IWG	Interagency Working Group
Ldn	day-night sound level
MDC	Missouri Department of Conservation
MoDOT	Missouri Department of Transportation
MoDNR	Missouri Department of Natural Resources
MTNF	Mark Twain National Forest
MU	map unit
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHD	National Hydrography Dataset
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
O_3	ozone
$PM_{2.5}$	particulate matter less than 2.5 micrometers in diameter
PM_{10}	particulate matter less than 10 micrometers in diameter

RFSS	Regional Forester Sensitive Species
SC	social cost
SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound

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1. Introduction

In September 2020, the Doe Run Resources Corporation (Doe Run) submitted three separate applications to the Bureau of Land Management (BLM) for modification of their existing Preference Right Leases to include an additional 1,550 acres of federal minerals managed by the BLM (Modification Lands). Existing lease areas and proposed Modification Lands are located near the Missouri communities of Viburnum and east of Bunker, and within the Salem and Potosi/Fredericktown Ranger District, Mark Twain National Forest (MTNF), Missouri (Figure 1- 1). The Modification Lands contain minerals that underly both federal surface in the MTNF and surface privately owned by Doe Run.

Lead mining in southeastern Missouri goes back to the 1700s. The Viburnum Trend, also known as the New Lead Belt, is a zone of mineralization which stretches south from the town of Viburnum, Missouri for over 30 miles. Doe Run has had prospecting permits from the BLM since the 1950s for exploratory drilling on the Salem and Potosi/Fredericktown Ranger Districts. Ore bodies were located and defined through prospecting permits which followed the BLM process into Preference Right Leases. Environmental analysis of the mine plans associated with the Preference Right Lease applications was conducted by the U.S. Geological Survey resulting in a decision to authorize mineral development on the leased lands. In 2015 Doe Run submitted requests for renewals of the BLM for Preference Right Leases. Following environmental analysis, the BLM renewed the 36 Preference Right Leases, totaling approximately 33,623 acres.

Doe Run-owned and leased lands now contain existing mines and extensive underground mining facilities that are immediately adjacent to the proposed Modification Lands. Ongoing mining operations on Doe Run-owned and leased lands produce lead, zinc, and copper.

The BLM is considering approval of the following modifications to leases held by Doe Run:

1. Lease MOBLMA-047477 (Fletcher Mine): Add 1,120 acres to the current lease of 1,297.5 acres of federal minerals underlying federal surface.

2. Lease MOBLMA-079252 (Sweetwater Mine): Add 240 acres to the current lease of 320 acres of federal minerals underlying federal surface.

3. Lease MOBLMA-046975 (Brushy Creek Mine): Add 190 acres to the current lease of 2,228.8 acres of federal minerals; 50 of these acres underlie Doe Run's privately-owned surface and 140 acres underlie federal surface.

The areas covered by the proposed lease modifications (the Project Area) are located on a combination of private land owned by Doe Run and federal lands in Reynolds and Shannon counties, Missouri (Figure 1-1). All activities planned to occur to support surface exploration efforts on the three expanded lease areas (e.g., removal of vegetation, surface drilling, access road construction) would occur over a maximum of 25 acres of surface lands.

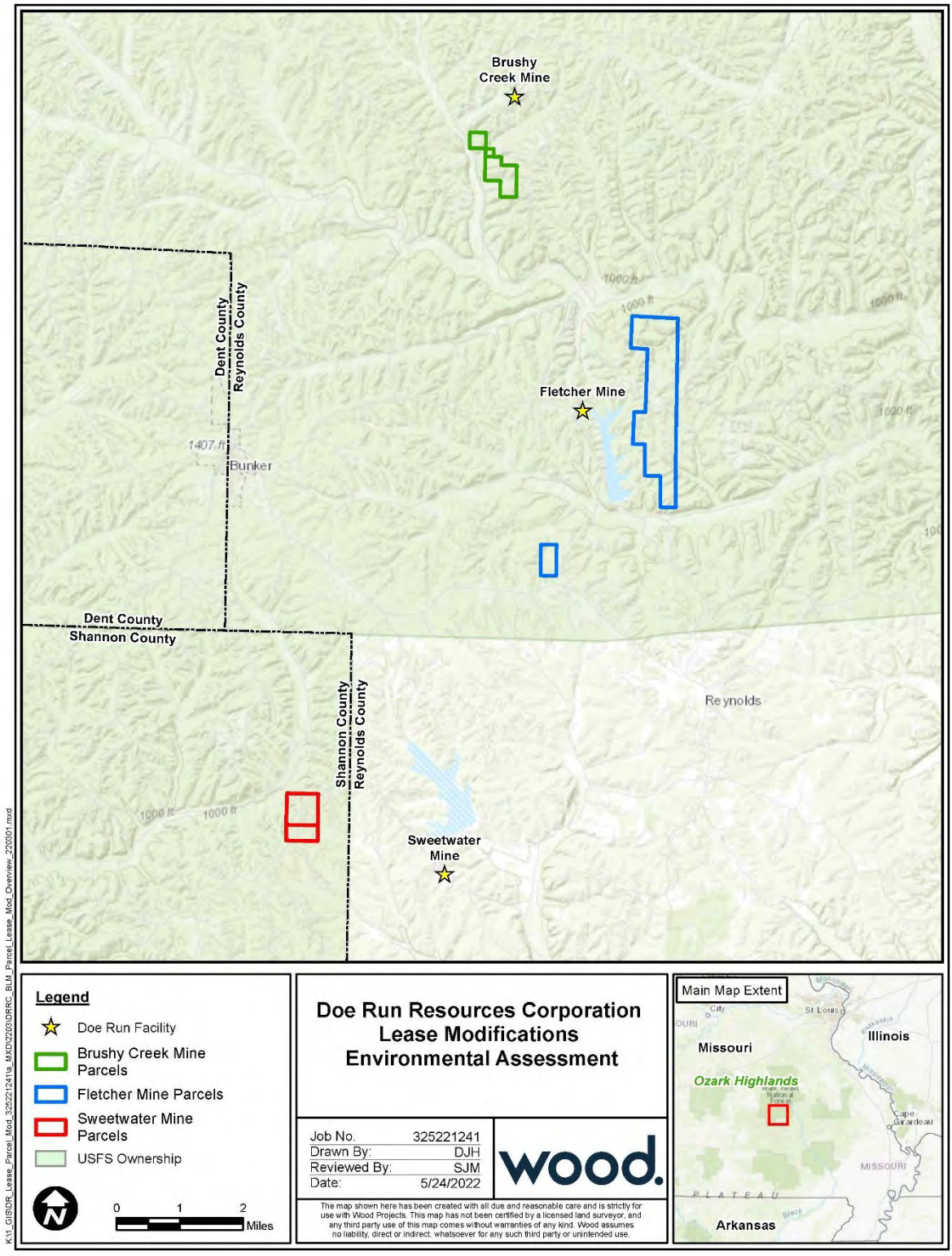

Figure 1-1. Project Area Overview

The BLM has prepared this draft environmental assessment (Draft EA) to analyze the potential impacts from surface exploration and underground mining that would result from approval of the proposed lease modifications. The purpose of this Draft EA is to assess potential impacts of the lease modifications (Proposed Action) and determine if mitigation measures are necessary to lessen impacts and otherwise strengthen environmental management of mine expansion in the lease modification areas.

Pursuant to the Mineral Leasing Act of 1920, 30 United States Code 181 *et seq.,* and other legal authorities, the BLM is authorized to lease deposits of certain minerals on lands owned by the United States. In addition to commonly known energy resources, such as coal, oil, and gas, the Mineral Leasing Act authorizes the BLM to lease non-energy minerals, such as lead, copper, and zinc. The BLM regulations implementing this authority for solid minerals (other than coal) are found at 43 Code of Federal Regulations (CFR) § 3500 – Leasing of Solid Minerals Other than Coal and Oil Shale. As described in § 3501.2, the subject minerals are those "minerals other than oil, gas, coal, and oil shale, leased under the mineral leasing acts, and those hardrock minerals leasable under Reorganization Plan No. 3 of 1946, on any unclaimed, undeveloped area of available public domain or acquired lands on which leasing of these specific minerals is allowed by law." Leasing these minerals on federal land provides valuable revenue to the states and the Federal Government.

Pursuant to 43 CFR 3510.21, "A modified lease will be subject to the same terms and conditions as in the original Federal lease". The BLM has reviewed the proposed lease modifications to determine their compliance with the terms and conditions identified in the 2015 lease renewal documents for MOBLMA-047477, MOBLMA-079252, and MOBLMA-046975 for Doe Run (Appendix A).

While the Secretary of Agriculture has administrative responsibility for surface resources on U.S. Forest Service (USFS) lands, the BLM has responsibility and authority over federally owned minerals (including those underlying National Forest System lands) and issues permits for hardrock minerals (e.g., lead, zinc, copper). The USFS is responsible for the administration of surface resources on the MTNF. Since most of the proposed Modification Lands are federally owned and managed by the USFS, the USFS is a cooperating agency for this EA, as defined in 40 CFR 1508.1.

This Draft EA was prepared in conformance with the Council on Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) (40 CFR 1500–1508) and the BLM NEPA Handbook H-1790-1 (BLM 2008). This Draft EA describes the environmental protection measures used by Doe Run to avoid or reduce potential environmental impacts and summarizes the actions relevant to the proposed activities and locations.

1.1. Purpose and Need for the Action

Doe Run has submitted three lease modification applications to the BLM for the addition of federal lands potentially containing ore reserves to enable their continued mining operations adjacent to existing lease areas. Doe Run has been actively mining the Viburnum Trend in southeast Missouri, one of the world's largest deposits of lead minerals, for more than 50 years, including mining operations at Fletcher, Sweetwater, and Brushy Creek mines. Doe Run owns and operates extensive underground mining and surface facilities immediately adjacent to the proposed Modification Lands. Given the depth of the minerals to be mined and the considerable

expense and potential impacts of accessing these minerals from a new surface location, expansion from the existing underground working into adjacent mineral deposits associated with the proposed lease modifications would provide the lowest cost and lower impact option for continued mining operations. This would allow Doe Run to continue providing ore concentrates to meet global demand for mined minerals and to maintain profitability into the future.

The purpose of the BLM action is to fulfill the responsibility assigned by the Mineral Leasing Act of 1920, the Federal Land Policy and Management Act of 1976, and the BLM's mineral leasing regulations at 43 CFR 3500 that require the BLM to review lease amendments, such as those proposed by Doe Run. The need for the BLM action is to either approve or deny Doe Run's proposed lease modification applications based on an evaluation of whether the applications would not cause unnecessary or undue degradation of public lands and include a sufficient plan for reclamation of the mining sites following use. The need for USFS action is to review this environmental analysis to determine if a consent decision is appropriate based on the impact to the surface resources in accordance with the Mark Twain National Forest 2005 Land and Resource Management Plan (2005 Forest Plan) (USFS 2005a).

Pursuant to 43 CFR 3510, lease modifications are appropriate when "the acreage of the modified lease, including the additional lands, is not in excess of the maximum size of 2,560 acres allowed for a lease, as specified" in 43 CFR 3503.37 and when the lands "contain known deposits of the same mineral deposit that can only be mined as part of the mining operations on the original Federal lease". The BLM has verified that the acreage applied for by Doe Run meets these standards.

1.2. Scope of the Federal Action

The scope of the federal action being considered in this Draft EA consists of the issuance of lease modifications for each of three mine sites. The areas encompassed by these lease modifications total 1,550 acres as shown in Figures 1-2, 1-3, and 1-4 and include the following:

- Modification Lands contiguous to lease MOBLMA-047477 (Fletcher Mine): 1,120 acres of federal minerals available for lease in Reynolds County, Missouri. This 1,120-acre package consists of two parcels: a 1,040-acre tract (T32N R1W Sections 7 Lot 1 NW1/4; E1/2; Section 8 Lot 1 SW1/4; E1/2; Section 19 NW1/4; E1/2 SE1/4) and an 80-acre tract (T32N R2W Section 25 W1/2 SW1/4).
- Modification Lands contiguous to lease MOBLMA-079252 (Sweetwater): 240 acres of federal minerals available for lease in Shannon County, Missouri. This 240-acre package consists of two parcels: a 160-acre tract (T31N R2W Section 17 SW1/4) and an 80-acre tract (T31N R2W Section 20 N1/2 NW1/4).
- Modification Lands contiguous to lease MOBLMA-046975 (Brushy Creek): 190 acres of federal minerals available for leasing in Reynolds County, Missouri. This 190-acre package consists of three parcels: a 40-acre tract, a 10- acre tract, and a 140-acre tract located at T33N R2W Sections 26 NW1/4 SW1/4, NW1/4; S1/2 SW1/4 NW1/4; N1/2 SW1/4; SE1/4 SW1/4; Section 27 NE1/4 NE1/4 and 27.

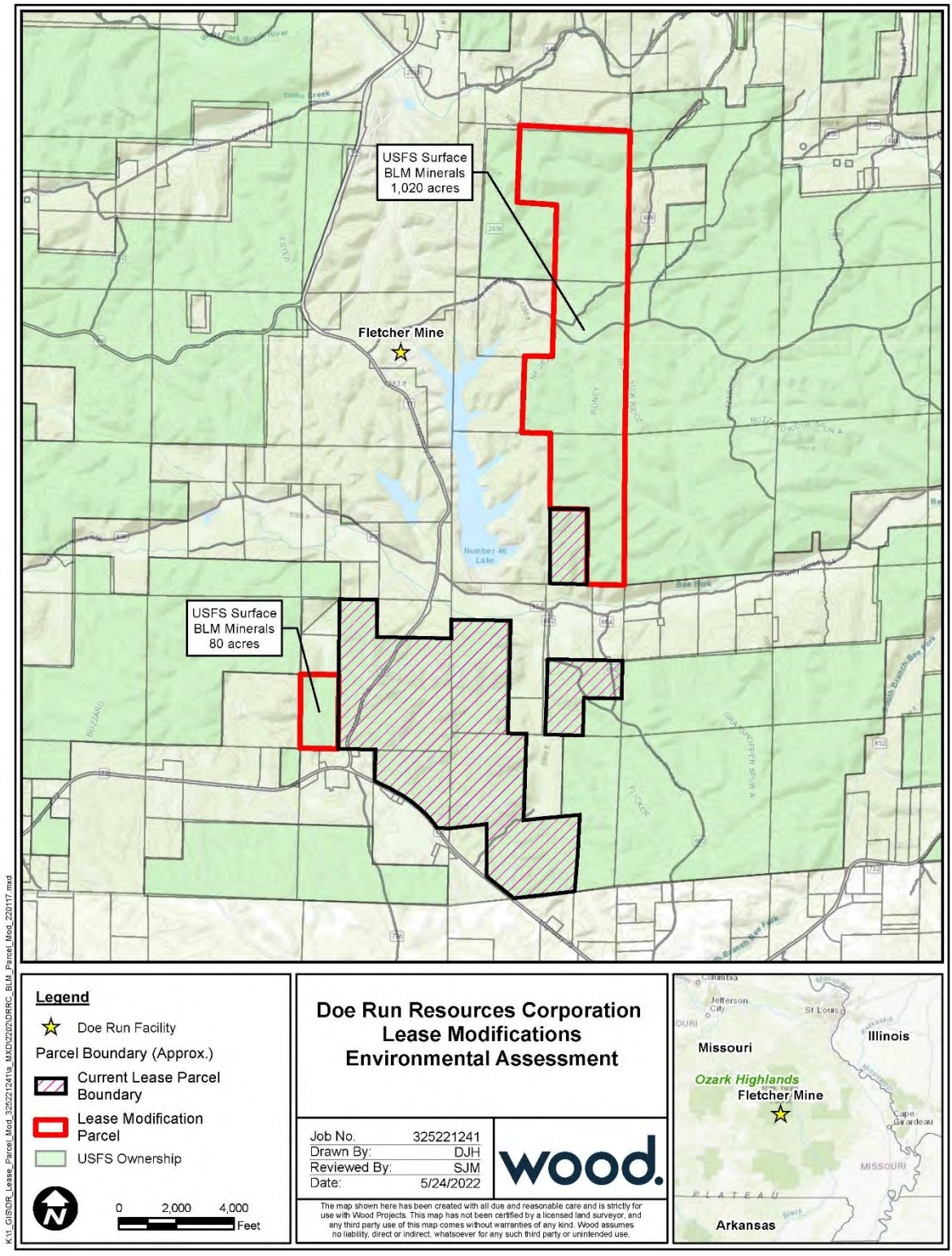

Figure 1-2. Fletcher Mine Proposed Lease Modification Project Area

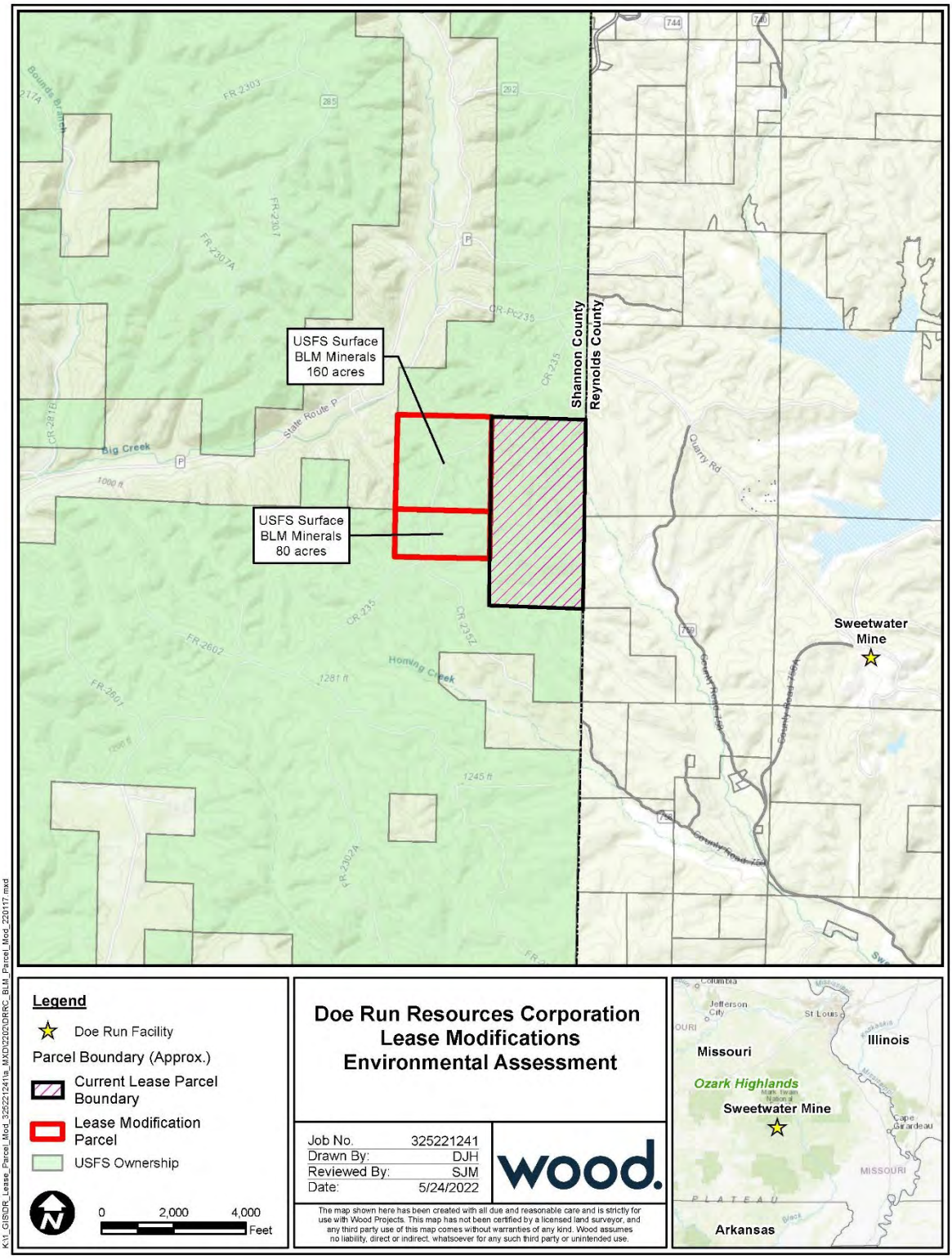

Figure 1-3. Sweetwater Mine Proposed Lease Modification Project Area

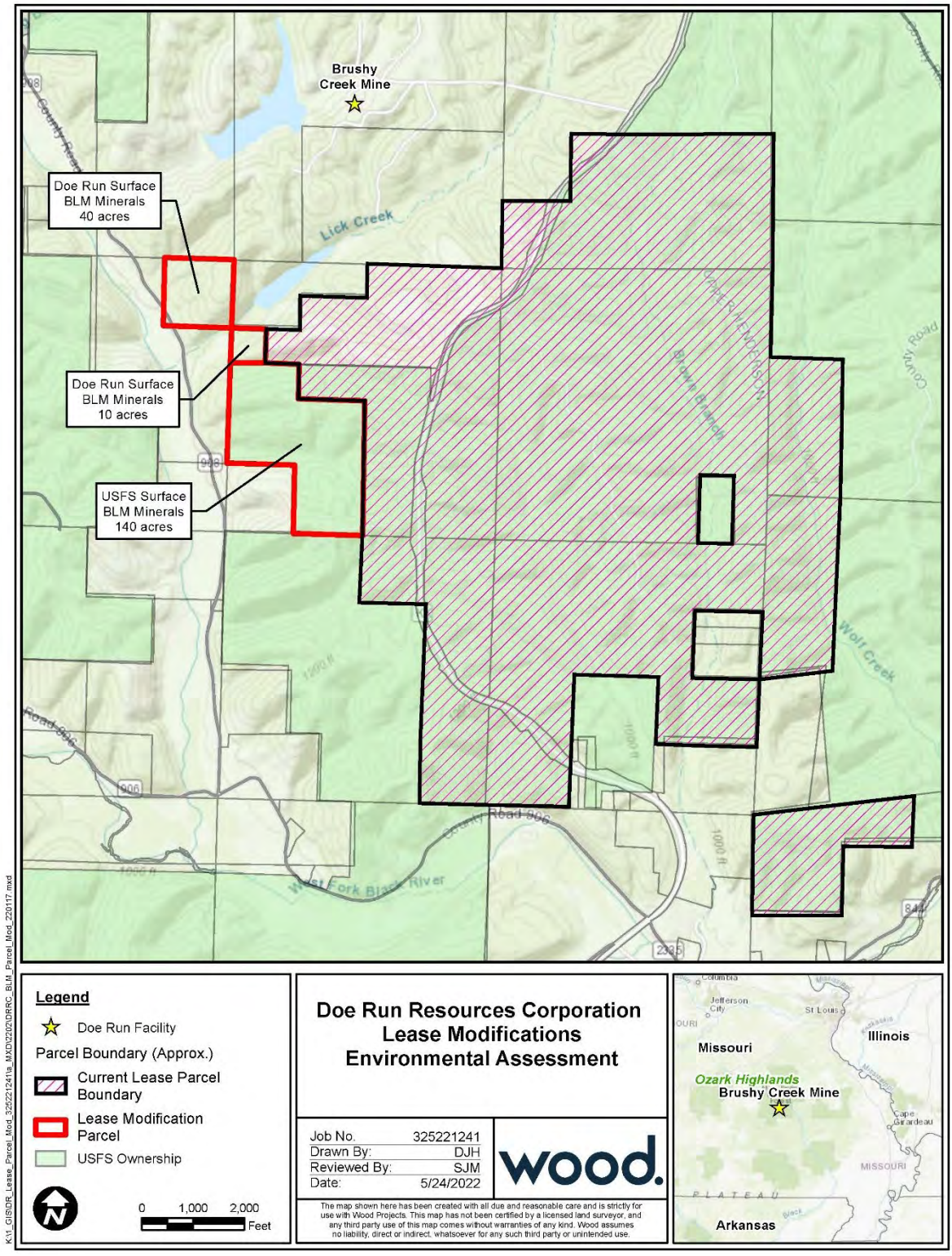

Figure 1-4. Brushy Creek Mine Proposed Lease Modification Project Area

1.2.1. Connected Actions

Per 40 CFR 1508.25, connected actions are proposed federal actions that are closely related and should be discussed in the same NEPA document. Actions are connected if they automatically trigger other actions that may require an environmental impact statement; cannot or will not proceed unless other actions are taken previously or simultaneously; or if the actions are interdependent parts of a larger action and depend upon the larger action for their justification (40 CFR 1508.25 (a)(1)). Connected actions are limited to federal actions that are currently proposed (ripe for decision). Actions that are not yet proposed are not connected actions but may need to be analyzed in the cumulative effects analysis if they are reasonably foreseeable.

Based on this definition, connected actions to the Proposed Action analyzed in this Draft EA include surface exploration drilling for mining expansions and potential expansion of subsurface mining. These actions are described in more detail in Section 2.2.

1.2.2. Decision To Be Made

This Draft EA has been prepared to inform BLM and USFS decisionmakers and the public about the environmental consequences of the Proposed Action. The BLM is lead agency for NEPA and interagency consultations and the USFS will decide whether to consent to the lease modifications, and if consent is granted, the Modification Lands would adhere to the existing terms, conditions, and stipulations needed for the protection of surface resources. Following thorough analysis under NEPA, the BLM will decide whether to modify the existing leases held by Doe Run under the current terms, conditions, and stipulations. The BLM and the USFS will use this Draft EA to support the decision-making process, to determine whether an environmental impact statement should be prepared or whether a Finding of No Significant Impact (FONSI) may be issued, and to formulate other administrative measures as necessary.

In addition to evaluating the regulatory compliance of activities proposed under the lease modification applications, the USFS (as a federal surface managing agency) must also consider potential impacts that could occur to air, water, biological resources, health, socioeconomics and environmental justice, land allotments, and cultural resources as a result of the Proposed Action and any alternatives to the Proposed Action. This Draft EA provides the USFS with the information needed to evaluate environmental effects to inform their decision of whether to consent to the BLM's lease modifications.

The USFS Responsible Official (Regional Forester) will determine the following after conducting and reviewing the environmental analysis contained within this Draft EA, the results of the public involvement effort, and input from interdisciplinary resource specialists:

- If the proposed activities and alternatives are responsive to the issues, accomplish Forest Plan direction, and meet the purpose and need as defined for the Doe Run Lease Modification Project;
- Which action or alternative to approve and implement;
- If the information in this analysis is sufficient to make an informed decision;
- If a Forest Plan Amendment is needed;
- If the activities can be implemented in a timely manner; and

- If the effects of the proposed activities will have significant effects.

The Forest Service's consent decision will be based on the impact to the surface resources consistent with the stipulations on the current leases and the 2005 Forest Plan. The USFS has the ultimate decision as to whether the action (modifying the leases) will impact the surface beyond an acceptable level. A consent decision would advise the BLM that the lease modifications would not interfere with the primary purpose for which the land was acquired. Details regarding the USFS administrative review process are described in Section 4.3.

1.3. Relationship to Plans, Statutes, Regulations, and Other Analyses

To ensure compliance with all environmental laws and regulations applicable to the proposed project, the BLM coordinated with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act (ESA); the Missouri State Historic Preservation Office (SHPO) under the National Historic Preservation Act (NHPA); the U.S. Environmental Protection Agency (EPA) for compliance with the Clean Water Act (CWA), Federal Water Pollution Control Act, Clean Air Act, Resource Conservation and Recovery Act, and Solid Waste Disposal Act; Native American tribes; and state and local agencies including the Missouri Department of Natural Resources (MoDNR) during development of this Draft EA.

In accordance with 43 CFR 3590.2, BLM's responsibilities for leased, licensed or permitted lands where operations for discovery, testing, development, mining, reclamation, or processing of minerals are being conducted, the BLM must respond to proposed applications after preparation of appropriate environmental analyses and consultation with the agency having jurisdiction over the lands with respect to the surface protection and reclamation aspects of such plan. The BLM is obligated to review lease applications to help determine if and how proposed activities comply with direction provided by the 2005 Forest Plan (USFS 2005a), federal law and regulation, and BLM and USFS policies. Modification of the existing lease to cover the 50 acres of minerals that underlie surface privately owned by Doe Run would need to comply with the BLM's Missouri Planning Analysis (1987), which is the existing land use plan developed for management of BLM-administered federal surface lands and federal minerals underlying non-USFS federal, state, and private surface lands in the state of Missouri.

This Draft EA is consistent with the purpose and goals of NEPA; CEQ NEPA implementing regulations at 40 CFR 1500-1508; the U.S. Department of the Interior's (DOI) NEPA regulations (43 CFR 46), as well as DOI policies including Secretarial Order No. 3399, Department-Wide Approach to the Climate Crisis and Restoring Transparency and Integrity to the Decision-Making Process, which requires DOI bureaus and offices to carry out the NEPA process as it stood before revisions to the NEPA regulations were issued by the CEQ in 2020.

1.4. Issue Identification

An environmental resources analysis was conducted in coordination with the BLM and USFS interdisciplinary team of resource specialists and planners. Resources in the Project Area that could potentially be impacted by the project are analyzed in detail in this Draft EA and summarized in Table 1-1. Resources either not present, or present but not affected to a degree requiring detailed analysis, were considered but dismissed; these resource topics are described in Section 1.4.2.

1.4.1. Issues Identified for Analysis

Table 1-1 lists the resources identified by the BLM and USFS interdisciplinary team that are present in the Project Area and have the potential to be affected by the Proposed Action.

Table 1-1. Issues Analyzed in Detail

Resource	Issue Statement
Air Quality/Climate Change	What would be the effects of the project on local, regional, and global air quality and global climate change?
Geology	What effects would subsidence have on natural resources and land uses within the MTNF and on the structural integrity of nearby residences and other structures as a result of the project?
	How would the proposed lease modifications and drilling activities affect the seismic sensitivities and earthquake propensity in the area?
Soils	How would the project affect soil structures and potentially contribute to shallower, less productive soil for use in restoration efforts?
	How would the project affect the likelihood of erosion and runoff?
	How would the project affect soil composition in areas surrounding the exploration road and drill pads?
	How would the project affect soil compaction and potentially limit root penetration, air and moisture infiltration, and vegetative growth?
Water Resources (Surface and Ground)	How would the project affect groundwater quantity or quality?
	How would the project affect surface water quantity or quality?
Wildlife (Terrestrial, Aquatic, and Special Status Species)	How would the project remove or alter habitat?
	How would the project disturb or displace wildlife?
Vegetation	Would the project affect vegetation and soils, such as through tree or soil removal or soil compaction?
	How would the project affect vegetative growth and productivity?
	How would the project affect the introduction or spread of invasive species?

Resource	Issue Statement
Cultural Resources	How would the project directly affect cultural sites? And are there indirect impacts to cultural setting due to noise and visual impacts of project facilities?
	How would the project affect Native American traditional cultural and religious concerns?
Human Health, Safety	What impacts would the project have on the health and safety of mine workers and the general public?
Socioeconomics and Environmental Justice	How would the project affect environmental justice populations (if they exist) in the vicinity of the Modification Lands?
	How would the project affect employment in the vicinity of the Modification Lands?
Transportation	How would the project affect traffic patterns and the transportation network in the project vicinity?
Recreation	How would the project affect existing recreational use of MTNF and other recreational areas in the vicinity?
Visual Resources	How would the project affect visual resources within MTNF and in the vicinity?

1.4.2. Issues Identified but Eliminated from Further Analysis

Issues outside the scope of this EA are those that are not directly related to decisions to be made regarding the Proposed Action and are not relevant to the purpose of and need for the action (Section 1.1). The following resources were identified during internal scoping as not present within the Project Area or vicinity and would therefore not be affected by the Proposed Action:

- Areas of Critical Environmental Concern – No areas of critical environmental concern exist within the MTNF or in the vicinity of the Project Area (USFS 2005b).
- Lands with Wilderness Characteristics – Although the MTNF Forest Plan (USFS 2005a) identifies seven Wilderness Areas and 13 Wilderness Study Areas, none are located within or immediately adjacent to the Project Area.
- Sage Grouse Habitat– No sage grouse habitat is known to exist within or immediately adjacent to the Project Area.
- Wild Horses and Burros – No wild horses or burros are known to exist within or immediately adjacent to the Project Area.
- Wild and Scenic Rivers– No designated wild or scenic rivers exist within or immediately adjacent to the Project Area.
- Livestock Grazing Allotment– No designated livestock grazing allotment areas are known to exist within or immediately adjacent to the Project Area.

2. Description of Alternatives

This chapter describes the two alternatives that are analyzed in Chapter 3: the No Action Alternative and the Proposed Action.

2.1. Alternative A – No Action Alternative

Under NEPA (40 CFR 1502.14), federal agencies are required to present the potential impacts of taking "no action". The No Action Alternative serves to provide a baseline for comparing anticipated impacts of the Proposed Action and thus helps to better inform BLM decision-making.

Under the No Action Alternative, the BLM would not approve the three lease modifications. Doe Run would not conduct any additional surface exploration, underground mining, or other activities described in the Proposed Action on the lands considered in the lease modification application.

Under this alternative, production at the Fletcher, Sweetwater, and Brushy Creek mines would continue under the current approved actions from 2015. Following depletion of the existing recoverable reserves within the existing leases, Doe Run would discontinue mining within the existing lease boundaries. Following this discontinuation, Doe Run would begin the process of recovering pillars, or untouched material left to support mine roof overburden, within the current lease areas.

2.2. Alternative B – Proposed Action

Under Alternative B, the BLM would authorize Doe Run's request for three lease modifications. At Fletcher Mine, the current lease covers 1,297.5 acres and the modification request would add 1,120 acres for a total of 2,417.5 acres. At Sweetwater Mine, the current lease is for 320 acres and the modification request would add 240 acres for a total of 560 acres. At Brushy Creek Mine, the current lease is for 2,228.8 acres and the modification request would add 190 acres for a total of 2,418.8 acres. The authorized lease modifications would be valid until 2025 when the existing leases would need to be renewed and would include the current lease stipulations (Appendix A).

Under the proposed lease modifications, Doe Run would conduct surface exploratory drilling and, dependent on the discovery of mineable resources, would potentially extend underground mining operations into the Project Area. Details regarding these activities are presented below.

Surface drill site and temporary access road construction and reclamation would be governed by the 2005 Forest Plan (USFS 2005a) and the existing leases, which contain stipulations designed to ensure environmental protection (Appendix A). Additional environmental protection design features are described in the Five Year Exploration and Operating Plans on file with the BLM for each mine (Doe Run 2016 and 2017). Excerpts from each plan that include these environmental protection design features are included in Appendix B.

2.2.1. Surface Disturbances

Under the Proposed Action, surface activities would include the development of approximately 61 exploration drill sites and associated temporary access roads primarily on forested lands that

would result in disturbance to no more than 25 acres of surface lands over all of the Modification Lands. Construction of new surface ventilation structures or other surface structures are not proposed in the Project Area.

2.2.1.1. Exploration Drill Sites

Under the Proposed Action, Doe Run would conduct an initial surface drilling exploration campaign of approximately 61 surface drill sites in the Project Area. Each drill site would require the construction of a drill pad prior to exploration drilling. Standard drill pad size is 100 feet by 90 feet or approximately 0.20 acres; therefore, the total surface area that would be covered by drill pads would be approximately 12.5 acres. The density and distribution of drill holes would vary annually based on exploration priorities and minerals discovered during drilling within both current and proposed lease areas. Where minerals are discovered, Doe Run would drill a higher density of holes. Preparation of some drill sites would require removal of vegetation, potentially including trees.

Prior to any disturbance, approval of specific locations for surface exploration holes and temporary access roads in the Project Area would be required by the BLM and USFS. Doe Run would submit letters known as 'notice of staking letters' to both agencies stating the intent to drill in certain areas. The agencies would conduct a review or site visit to review proposed locations for drill holes and access roads. Adjustments must be approved by the BLM and USFS authorized officials in coordination with Doe Run surface drill supervisor.

After the drill site approval process is completed, drill site development may occur. A typical drill site requires an average of 20 hours to construct using a dozer (D6 or similar), an excavator (CAT326 or similar), and a tandem dump truck to transport rock used to create the drill pad. Approximately 150 tons of rock would be required at a typical access road and drill site to create level working and driving surfaces; however, the amount may vary depending on the road and pad specifications.

Surface exploratory drilling would utilize diamond core drilling equipment, which would typically include the following:

- Truck-mounted Longyear LF 70 drill rig or similar
- Flatbed truck to haul drill rods to the drill site
- Flatbed truck with mounted container to haul water
- Trailer-mounted driller's shelter
- Quarter-ton pickup truck for transportation of rock

Doe Run and third-party contractors may substitute or use additional similar exploratory drilling equipment as needed.

Each drill site would be manned by a two-person crew that would drill core holes to extract preserved mineral core samples using diamond-tipped core bits. Mine workers would core from the surface and penetrate the underlying rock formations. Total depth of the drill holes would range from 1,300 feet below ground surface (bgs) to 3,200 feet bgs. The core drilling process is typically completed in approximately 130 hours, with crews reaching an average drilling depth between 100 to 200 feet per shift, depending on shift duration and geologic conditions.

Water used for drilling activities would be obtained from either a natural surface water source outside of USFS-owned lands or from the mine site, depending on proximity to a water body, and transported in water containers mounted on flatbed trucks. Each water truck holds approximately 2,000 gallons and up to 40 trips may be needed to complete the drill site, though the amount may vary depending on the depth drilled. Excess water and drill cuttings would be collected in a sump on the drill site in accordance with procedures defined in the Five Year Exploration Plan on file with the BLM (Doe Run 2016). Cuttings from each drill hole would be collected in the sump and, upon completion of drilling, the cuttings collection pit would be reclaimed by allowing the pit to dry and then backfilling with the excavated soil. Surface holes would be abandoned and plugged according to the existing stipulations (Appendix A), current Exploration Plan, and MoDNR regulatory requirements.

Surface drill sites would typically be reclaimed within three months following drill hole plugging, depending on weather conditions. During restoration, Doe Run would restore affected areas to approximate pre-drilling conditions, including the removal of any rock that has been placed on drill sites and access roads. Slopes would be recontoured to match the pre-disturbance state. Reclaimed drill sites would be replanted with winter wheat (*Triticum aestivum*) to control erosion. Materials used at the drill sites such as fencing, trash, core trays, tools, and other miscellaneous supplies and material would be removed at the end of the drilling process. Drill sites constructed on federal land would be inspected by the USFS prior to final approval of restoration.

2.2.1.2. Access Roads

Under the Proposed Action, Doe Run would develop temporary access roads for each exploration drill site. Temporary access road length would be dependent on the distance of a site from existing roads. On average, each access road would be 0.08 miles (422 feet) long and 15 feet wide, or a total of 0.15 acres per drill site. Therefore, the total surface area that would be disturbed by the roads for all of the drill sites would be approximately 9.2 acres. Existing private, state, county, and USFS roads would be used to access areas for surface drilling. Approval from the USFS would be obtained prior to the use of existing USFS system roads by way of a Road Use Permit.

Upon completion of drilling and abandonment of the drill holes, Doe Run would restore temporary access roads to the approximate pre-disturbance condition. Restoration activities would be done in accordance with the standards outlined in the 2005 Forest Plan to minimize environmental impacts. Any rock placed along the road would be removed, slopes would be recontoured to match the pre-disturbance state, and the area would be replanted with winter wheat to control erosion. Temporary access roads constructed on federal land would be inspected by the USFS prior to final approval of restoration.

2.2.2. Reasonably Foreseeable Mine Operations

Approval of the proposed lease modifications would provide a logical extension of Doe Run's current mining operations. Development of the mineral resources at the Fletcher, Sweetwater, and Brushy Creek mines within the Modification Lands would occur in a manner similar to that used at the existing mines, assuming that mineral resources are identified during the exploration drilling program. Mining would be performed underground, typically at a depth of about 1,000 feet bgs, on proposed Modification Lands. The "mechanized room and pillar" mining method,

which involves mining out underground cavities while leaving the surrounding unmined waste or ore as primary support, would be carried out using rubber-tired equipment, loaders, and drill jumbos. Underground mining operations would be done in compliance with the current Operating Plan on file with the BLM.

2.2.3. Applicant-Committed Environmental Protection Design Features

Environmental protection design features are common practices that Doe Run uses to avoid or reduce potential environmental impacts in their regular operations and are incorporated into the Proposed Action. These design features are described in the Exploration Plan and Operating Plan on file with the BLM for each mine (Doe Run 2016 and 2017). Details for specific environmental protection design features incorporated into the Proposed Action are included in Appendix B. Environmental protection design features that are incorporated into the Proposed Action include the following:

- Doe Run plugs each test hole upon completion of coring in accordance with applicable state regulations to mitigate potential subsidence and minimize impacts to groundwater.
- Doe Run plugs each surface exploration test hole with approved materials as specified by MoDNR to ensure that the Ozark and St. Francois aquifers waters do not intermingle.
- Sumps (a temporary pit constructed to trap and filter water) at surface exploration drilling sites are constructed to collect drill cuttings and excess water created during the drilling process. Sump locations are selected by considering proximity to water sources and topography.
- Upon completion of drilling, the sumps are reclaimed and the drill site remediated to meet USFS standards. Sites would be contoured to natural grade and where appropriate, sites would be hydroseeded with the following: 50 pounds of agricultural lime, 1 pound P(phosphorus)- N(Nitrogen)-K(Potassium) fertilizer (13-13-13), 5 pounds of Profile cover grow mulch (containing 58% cellulose fiber, 37% wood fiber, 5% tackifer), and 1 pound of winter wheat per 100 square feet of bare soil.
- Doe Run implements best management practices (BMPs) to protect surface and groundwater and ensure that no spilling or dumping of materials (e.g., petroleum product, toxic chemicals, etc.) would take place on BLM lease areas.
- Doe Run uses BMPs including adjustments to pillar extraction plans based on local geology, and work with third-party contractors to do stability analysis to ensure the long-term stability of the area and prevent widescale subsidence.

3. Affected Environment and Environmental Impacts

This chapter describes the baseline environmental conditions (affected environment) of resources in the Project Area and the anticipated environmental consequences (or impacts) that would occur from implementation of the alternatives described in Chapter 2.

3.1. Methodology

3.1.1. Affected Environment Methodology

The affected environment summarizes the current physical, biological, social, and economic environments of the area within and surrounding the proposed Project Area. For each resource, the elements or components of the resource potentially affected are described. For some resource areas, the geographic area for analysis of the affected environment extends beyond the Project Area to encompass the surrounding region; this is noted as relevant in the resource sections below. However, for many of the resource areas potentially affected by the alternatives, the area of analysis is located within the footprint of the Project Area, where drilling would occur and proposed surface structures would be located.

3.1.2. Environmental Consequences Methodology

The analysis of environmental consequences for each resource area considers how the condition of a resource area would change as a result of implementing each of the alternatives and describes the types of impacts that would occur (direct, indirect, beneficial, adverse). The significance of impacts is assessed using two parameters: magnitude and duration; these are described below.

The terms “impacts” and “effects” are used interchangeably in this chapter. According to the CEQ’s NEPA Regulations at 40 CFR 1500-1508, direct effects are effects that are caused by the action and occur at the same time and place (1508.8(a)). Indirect effects are effects that are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect effects also include “induced changes” in the human and natural environments (1508.8(b)). In other words, direct impacts are those that would be caused directly by the Proposed Action, such as drilling that could cause soil displacement. Indirect impacts are those follow-on effects induced by the initial impact. Loss of soil (soil erosion) could cause adverse impacts on water quality, such as turbidity and stream sedimentation.

Identified impacts may be either adverse or beneficial. The CEQ Guidelines that govern NEPA implementation describe the need for identifying and differentiating between adverse and beneficial impacts but do not offer a definition of these terms. For the purposes of this analysis, adverse impacts are those which, in the judgment of an expert resource area analyst, are regarded by the general population as having a negative and harmful effect on the analyzed resource area. Beneficial impacts are those which, in the judgment of an expert resource area analyst, are regarded by the general population as having a positive and supportive effect on the condition or appearance of the resource area or a change that moves the resource area toward a desired condition.

In this document, four levels of magnitude will be used to characterize the level of impacts as follows:

- No impact – the resource is not present or would not be affected by the project alternatives under consideration.
- Minor (or "small") – environmental effects to the resource are barely detectable or would be minimal enough to neither destabilize nor noticeably alter any important attribute of the resource.
- Moderate – environmental effects are sufficient to noticeably alter, but not to destabilize, important attributes of the resource.
- Large – environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Duration of impacts are categorized as follows:

- Permanent – Impact would last indefinitely.
- Long-term – Impact would likely last until completion of operations.
- Short-term – Impact would last the duration of the construction phase and through a portion of the operation period.
- Temporary – Impact would last for a portion of or throughout the construction phase only.

Information pertaining to the methods of drilling and mining, land characteristics, and other important aspects of the Doe Run existing mining operations and areas were used to examine the potential impacts of exploration drilling and mining operations in the proposed lease modification areas for all resource topics.

3.2. Air Quality and Climate Change

3.2.1. Affected Environment

3.2.1.1. Air Quality

The National Ambient Air Quality Standards (NAAQS) are a set of nationwide standards established by the EPA under the federal Clean Air Act for pollutants that are common in outdoor air, considered harmful to public health and the environment, and that come from numerous and diverse sources. These nationwide standards set limits on the atmospheric concentration of six "criteria" pollutants – carbon monoxide (CO), lead, nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), and particulate matter ($PM_{2.5}$ and PM_{10}) (EPA 2022a, 2022b). According to the NAAQS, areas are designated as "attainment" (meeting) or "nonattainment" (not meeting) EPA standards for air quality management.

General Conformity regulations established by the EPA ensure that actions taken by federal agencies do not interfere with a state's plans to attain and maintain national standards for air quality. Established under the Clean Air Act (Section 176(c)(4)), the General Conformity rule helps states and tribes improve air quality in those areas that do not meet the NAAQS. Under the General Conformity rule, federal agencies must work with state, tribal, and local governments in

nonattainment or maintenance areas to ensure that federal actions conform to the air quality plans established in the applicable state or tribal implementation plan.

The proposed Project Area is located within Reynolds and Shannon counties, Missouri. Both counties are in attainment for NAAQS for CO, NO_2, O_3, SO_2, $PM_{2.5}$ and PM_{10}. Sections 5-7 of T33N, R1W and Sections 1-3 and 10-12 of T33N, R2W in Reynolds County are considered nonattainment for lead; the remainder of the county is in attainment, including the proposed project area.

The MoDNR administers, regulates, and enforces state air pollutant regulations via issuance and enforcement of permits. Missouri has state ambient air quality standards for hydrogen sulfide and sulfuric acid (Missouri Secretary of State 2022). However, emissions of hydrogen sulfide and sulfuric acid are not considered in this analysis as these compounds are not produced or emitted during exploration or underground mining and associated operations.

Ozone is formed from a photochemical reaction between oxygen, volatile organic compounds (VOC), and NO_2. VOC are compounds containing carbon with a low vapor pressure. Since VOC emissions are regulated to control O_3 formation, VOC emissions are included in this analysis instead of O_3.

3.2.1.2. Greenhouse Gases

Greenhouse gases (GHGs) are gases in the atmosphere that absorb infrared electromagnetic radiation, contributing to the greenhouse effect. Increasing the concentration of GHGs in the atmosphere amplifies the greenhouse effect, changing our climate, including changes in temperature, precipitation, and other variables (U.S. Global Change Research Program 2017).

GHGs including carbon dioxide (CO_2) and water vapor are emitted into the atmosphere through natural processes and human activities. Other GHGs (e.g., fluorinated gases) are created and emitted solely through human activities. The primary GHGs that enter the atmosphere due to anthropogenic activities include CO_2, methane (CH_4), nitrous oxide (N_2O), and fluorinated gases such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (SF_6), with CO_2 being the most abundant anthropogenic GHG emitted (BLM 2020).

The impacts from GHGs on global warming vary depending on how long the compounds lasts in the atmosphere and its ability to absorb infrared radiation. To measure and compare climate change impacts between various GHGs, a factor was developed for each GHG to account for these effects; this factor is known as the Global Warming Potential. Emissions of GHGs are converted into an equivalent amount of CO_2 (CO_2e) by multiplying the GHG by its global warming potential. The larger the global warming potential, the more radiative adsorption of the GHG relative to an equal amount of CO_2 (BLM 2020).

The Intergovernmental Panel on Climate Change (IPCC) recently concluded that “since systematic scientific assessments began in the 1970s, the influence of human activity on the warming of the climate system has evolved from theory to established fact” (IPCC 2021).

The annual average surface temperatures for the contiguous U.S. have increased 1.0°C (1.8°F) from 1900 to 2019 (BLM 2020). Annual average surface temperatures are expected to increase by about 1.4ºC (2.5ºF) regardless of future GHG emissions. Models of future GHG emissions demonstrate an increase the global average surface temperature between 1.6ºC (3.0ºF) to 6.6ºC (12ºF), depending on a low or high worldwide GHG emissions scenario. The conterminous U.S.

has experienced varying rates of climate change, as the length of frost-free seasons have increased since the early 1900s, the frequency of cold waves has decreased since the early 1900s, and the frequency of heat waves has increased since the mid-1960s (BLM 2020).

Because GHGs circulate freely throughout Earth's atmosphere, the region of influence for GHGs is the entire globe. The largest component of global anthropogenic GHG emissions is CO_2. Global anthropogenic GHG emissions reached 700 gigatons (700,000,000,000 metric tons) in 2019, with CO_2 emissions from fossil-fuel combustion comprising 64% of that total, and the remainder resulting from land use change (IPCC 2021).

Potential impacts to air quality due to climate change vary. Although potential GHG emissions at the project level can be quantified, currently methodologies do not permit an assessment between project-scale GHG emissions and specific effects on climate change, as effects on climate change are influenced by global GHG emissions. For Missouri, the EPA has identified the following continued changes due to an increasingly warmer climate (EPA 2016):

- Increase in the intensity and frequency of both floods and droughts, especially along the Mississippi River
- Changes to the ranges of plants and animals
- Reduced agricultural and dairy yields and threats to cow health
- Increases in the length and severity of the pollen season
- Higher temperatures and more frequent and severe heat waves, which can threaten human health by causing heat stroke and dehydration
- Decreases in air quality due to the increase in formation of ground-level ozone, a pollutant that causes lung and heart problems and harms plants

MoDNR administers, regulates, and enforces GHG regulations via issuance of permits for major sources of air pollution or GHGs, while the EPA issues regulations and requires annual emissions reports of large generators of GHGs.

3.2.1.3. Air Emissions at Existing Doe Run-Leased Lands

Ongoing BLM-managed mineral development activities generate direct GHG emissions during site preparation and exploratory drilling activities, which includes the construction of support infrastructure (e.g., temporary access roads). CO_2, CH_4, and N_2O emissions are generated by fossil fuel-fired internal combustion engines used during these activities. Current allowable emissions rates for mining operations at the three Doe Run-leased lands are provided in Table 3- 1.

Table 3-1. Current Allowable Emissions Rates for Mining Operations

Site	CO tons	NO_X tons	PM_{10} tons	$PM_{2.5}$ tons	SO_X tons	VOC tons	Lead tons	Total HAP tons	CO_2e tons[†]
Brushy Creek	3.61	6.25	28.63	4.33	0.01	3.27	2.91	2.91	838
Fletcher	52.87	20.43	144.63	144.63	1.26	4.36	6.02	6.02	2,740
Sweetwater	<0.01	<0.01	21.19	4.96	<0.01	<0.01	<0.01	0.01	--

[†] Not included in a permit; estimated using stationary internal combustion engine diesel fuel emissions factors for CO_2e.

Direct air pollutant emissions for ongoing underground mining activities and their associated milling operations for the three existing mines on lands currently leased by Doe Run were obtained from the Missouri Emissions Inventory Questionnaire (EIQ). The reported emissions do not include fugitive emissions (from roadways), vehicle emissions, or GHGs, as these emissions were not required to be included in the EIQ. The previously reported air emissions from each of the three mines are provided in Table 3-2 (MoDNR 2013a, 2014, 2013b).

Table 3-2. Direct Emissions from Current Mining Operations

Site	Year	CO tons	NO_X tons	PM_{10} tons	$PM_{2.5}$ tons	SO_X tons	VOC tons	Lead tons	Total HAP tons
Brushy Creek	2013	<0.01	<0.01	17.13	2.56	<0.01	2.12	0.35	0.04
Fletcher	2014	<0.01	<0.01	30.4	4.88	<0.01	2.74	0.84	0.08
Sweetwater	2013	<0.01	<0.01	60.96	10.95	<0.01	2.46	0.3	0.16

Source: MoDNR 2013a, 2013b, 2014

Annual emissions of lead and lead compounds, copper and copper compounds, and zinc and zinc compounds are also reported to the EPA as part of its annual toxic release inventory. The air emissions for these pollutants at each of the three existing mines currently leased by Doe Run are provided in Table 3-3 as an average of the previous three years (EPA 2022c).

Table 3-3. Direct Emissions from Mining Operations (including Fugitive Emissions)

Site	Year	Pollutant	Fugitive lbs.	Stack lbs.	Total lbs.
Brushy Creek	2018	Copper	72	3	75
Brushy Creek	2019	Copper	59	3	62
Brushy Creek	2020	Copper	2	59	61
Brushy Creek	**Average**	**Copper**			**66**
Brushy Creek	2018	Lead	630	47	677
Brushy Creek	2019	Lead	684	47	731
Brushy Creek	2020	Lead	787	47	834
Brushy Creek	**Average**	**Lead**			**747**
Brushy Creek	2018	Zinc	297	12	309
Brushy Creek	2019	Zinc	283	13	296
Brushy Creek	2020	Zinc	283	12	295
Brushy Creek	**Average**	**Zinc**			**300**
Fletcher	2018	Copper	49	2	51
Fletcher	2019	Copper	98	3	101
Fletcher	2020	Copper	133	4	137
Fletcher	**Average**	**Copper**			**96**

Site	Year	Pollutant	Fugitive lbs.	Stack lbs.	Total lbs.
Fletcher	2018	Lead	821	42	863
Fletcher	2019	Lead	828	42	870
Fletcher	2020	Lead	891	47	938
Fletcher	**Average**	**Lead**			**890**
Fletcher	2018	Zinc	91	3	94
Fletcher	2019	Zinc	46	2	48
Fletcher	2020	Zinc	95	2	97
Fletcher	**Average**	**Zinc**			**80**
Sweetwater	2018	Copper	55	0	55
Sweetwater	2019	Copper	45	0	45
Sweetwater	2020	Copper	0	42	42
Sweetwater	**Average**	**Copper**			**47**
Sweetwater	2018	Lead	641	27	668
Sweetwater	2019	Lead	755	27	782
Sweetwater	2020	Lead	738	27	765
Sweetwater	**Average**	**Lead**			**738**
Sweetwater	2018	Zinc	185	2	187
Sweetwater	2019	Zinc	156	2	158
Sweetwater	2020	Zinc	162	2	164
Sweetwater	**Average**	**Zinc**			**170**

Source: EPA 2022c

Lead and lead compounds are a subset of PM and other air pollutant, and GHG emissions are correlated to lead production. As indicated in Table 3-3, current lead and lead compound emissions are below the values reported in the EIQ for the Fletcher Mine in 2013 and 2014.

3.2.1.4. Monetized Impacts of GHGs

The “social cost of carbon”, “social cost of nitrous oxide”, and “social cost of methane” together being 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.

On January 20, 2021, President Biden issued Executive Order (EO) 13990, *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis*. Section 1 of EO 13990 establishes an Administration policy to, among other things, listen to the science; improve public health and protect our environment; ensure access to clean air and water; reduce GHG emissions; and bolster resilience to the impacts of climate change. Section 2 of the EO calls for Federal agencies to review existing regulations and policies issued between January 20, 2017, and January 20, 2021 for consistency with the policy articulated in the EO and to take appropriate action.

Consistent with EO 13990, the CEQ rescinded its 2019 “Draft National Environmental Policy Act Guidance on Considering Greenhouse Gas Emissions” and has begun to review and update its “Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews” issued on August 5, 2016 (2016 GHG Guidance). While CEQ works on updated guidance, agencies are instructed to use all tools and resources available to them in assessing GHG emissions and climate change effects, including the 2016 GHG Guidance.

Regarding the use of Social Cost of Carbon or other monetized costs and benefits of GHGs, the 2016 GHG Guidance noted that NEPA does not require monetization of costs and benefits. It also noted that "the weighing of the merits and drawbacks of the various alternatives need not be displayed using a monetary cost-benefit analysis and should not be when there are important qualitative considerations."

Section 5 of EO 13990 emphasized how important it is for federal agencies to "capture the full costs of greenhouse gas emissions as accurately as possible, including by taking global damages into account" and established an Interagency Working Group (IWG) on the Social Cost of Greenhouse Gases. In February 2021, the IWG published *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide: Interim Estimates under Executive Order 13990* (IWG 2021). This interim report updated previous guidance from 2016. The final report, originally scheduled for publication in January 2022, was temporarily delayed by a court injunction, but is undergoing peer review as of June 2022 (EPA 2022e).

For Federal agencies, the best currently available estimates of the SC-GHG are the interim estimates of the social cost of carbon dioxide ($SC\text{-}CO_2$), methane ($SC\text{-}CH_4$), and nitrous oxide ($SC\text{-}N_2O$) developed by the IWG on the SC-GHG. Select estimates are published in the Technical Support Document (IWG 2021) and the complete set of annual estimates are available on the Office of Management and Budget's website.

The IWG's SC-GHG estimates are based on complex models describing how GHG emissions affect global temperatures, sea level rise, and other biophysical processes; how these changes affect society through, for example, agricultural, health, or other effects; and monetary estimates of the market and nonmarket values of these effects. One key parameter in the models is the discount rate, which is used to estimate the present value of the stream of future damages associated with emissions in a particular year. A higher discount rate assumes that future benefits or costs are more heavily discounted than benefits or costs occurring in the present (i.e., future benefits or costs are a less significant factor in present-day decisions). The current set of interim estimates of SC-GHG have been developed using three different annual discount rates: 2.5%, 3%, and 5% (IWG 2021).

As expected with such a complex model, there are multiple sources of uncertainty inherent in the SC-GHG estimates. Some sources of uncertainty relate to physical effects of GHG emissions, human behavior, future population growth and economic changes, and potential adaptation (IWG 2021). To better understand and communicate the quantifiable uncertainty, the IWG method generates several thousand estimates of the social cost for a specific gas, emitted in a specific year, with a specific discount rate. These estimates create a frequency distribution based on different values for key uncertain climate model parameters. The shape and characteristics of that frequency distribution demonstrate the magnitude of uncertainty relative to the average or expected outcome.

To further address uncertainty, the IWG recommends reporting four SC-GHG estimates in any analysis. Three of the SC-GHG estimates reflect the average damages from the multiple simulations at each of the three discount rates. The fourth value represents higher-than-expected economic impacts from climate change. Specifically, it represents the 95th percentile of damages estimated, applying a 3% annual discount rate for future economic effects. This is a low probability, but high damage scenario, represents an upper bound of damages within the 3% discount rate model.

3.2.2. Environmental Impacts

3.2.2.1. Impacts of Alternative A – No Action Alternative

Under the No Action Alternative, the BLM would not approve the three proposed lease modifications. Doe Run would not conduct any additional surface exploration, underground mining, or other activities described in the Proposed Action that could affect air quality within the region. Emissions would continue to occur due to the current mining operations on existing Doe Run-leased lands, however no additional SC-GHGs or other SCs would be incurred under the No Action Alternative.

3.2.2.2. Impacts of Alternative B – Proposed Action

Air pollutant and GHG emissions were estimated for this project using emissions factors and calculations developed by the EPA, as well as information on air pollutant emissions provided by Doe Run.

Since the proposed Project Area is not located in a part of a county that is designated as a nonattainment or maintenance area for NAAQS and proposed mining activities would not cause any area to be reclassified as a non-attainment area for any of the NAAQS, a general or transportation conformity analysis is not required.

However, as the Proposed Action would involve the combustion of fossil fuels, which would generate GHG emissions, the BLM must include an inventory of GHG emissions in its analysis. The standard BLM approach to assessing potential impacts to climate is to quantify and project GHG emissions on project lands.

Impacts to regional air quality are expected to result from both surface disturbances related to mineral exploration and additional underground mining activities. While surface disturbances would be limited to investigations of the type, depth, and amount of lead, zinc, and copper within the subsurface federal mineral reserves, this analysis assumes that additional underground mining would follow initial investigations under the Proposed Action. Surface disturbances associated with mineral exploration and associated activities would not generate lead or sulfuric acid emissions as the drill encapsulates the core sample. However, underground mining of lead, zinc, and copper would continue to generate additional direct air pollutants (including lead) and GHG emissions from mining and transportation of mined material and indirect air pollutants (including lead and sulfuric acid) and GHG emissions from processing and purification of mined materials. Emissions as a result of mining are regulated by the MoDNR through issued air permits.

While it is not possible to quantify future air pollutants and GHG emissions from surface disturbances within the affected area of the Proposed Action with precision, the BLM develops emissions estimates based on general assumptions regarding the equipment needed to conduct exploration and construct support infrastructure (e.g., access roads). For each lease modification, the BLM develops Reasonably Foreseeable Development Scenario projections. These Reasonably Foreseeable Development Scenario projections are the result of technical analyses and an understanding of the equipment and resources needed to conduct mineral exploration in

the proposed Project Area. The BLM has developed the following assumptions to facilitate analysis of air pollutant and GHG emissions:

- The Proposed Action would entail installation of approximately 61 exploratory holes, with a maximum surface disturbance of 25 acres in seven separate parcel areas on Modification Lands adjacent to the Fletcher Mine (two parcels), Sweetwater Mine (two parcels), and Brushy Creek Mine (three parcels).
- The Proposed Action would continue current mining production values for lead, copper, and zinc for the length of the lease (until 2025).

Emissions from Surface Disturbances

GHG and air emissions from surface disturbances related to mineral exploration under the Proposed Action would be limited to fossil fuel combustion during use of construction equipment and operation of the surface drill sites. This includes emissions from vehicles driving to and from the exploratory sites and engines that drive the drilling and earth-moving equipment that produce CO_2, CO_2e, NO_2, $PM_{2.5}$, PM_{10}, SO_2, and VOC in varying quantities depending on the age, type, and condition of the equipment.

During site preparation and clearing, PM_{10} and $PM_{2.5}$ emissions would be generated by earth-moving activities associated with the creation of access roads and drill site development. The movement of construction vehicles and travel to the drilling sites also generates PM_{10} and $PM_{2.5}$ emissions from the roadbed surface. Estimates of the PM_{10} and $PM_{2.5}$ emissions generated by these activities are provided in Table 3-4. The combustion of fossil fuels by earth moving equipment, personal vehicles, and boring / drilling rigs generates air pollutants and GHG emissions. Estimates of the emissions generated by these activities are also provided in Table 3- 4.

Table 3-4. Direct Air Emissions from Drill Pad and Access Road Construction

Source	CO tons	NO_X tons	PM_{10} tons	$PM_{2.5}$ tons	SO_2 tons	VOC tons	Total HAP tons	CO_2e tons
Fugitive Dust								
Traffic	0	0	2.47	0.27	0	0	0	0
Road	0	0	0.01	0.01	0	0	0	0
Grading	0	0	0.03		0	0	0	0
Tailpipe Emissions								
Heavy Diesel	0.12	0.31	0.01	0.01	0	0.02	0	19.36
Light Gasoline	2.82	0.26	0	0	0	0.19	0.04	146.70
Diesel	0.22	1.19	0.04	0.04	0	0.09	0.00	158.31
Total	**3.16**	**1.76**	**2.56**	**0.33**	**0**	**0.30**	**0.04**	**324.37**

Based on Reasonably Foreseeable Development Scenario projections of 61 sites, exploration surface disturbances associated with both construction and transportation under the Proposed Action would increase the total statewide annual air pollutant and GHG emissions as listed in Table 3-5.

Table 3-5. Combined Emissions from Proposed Action – Exploration Surface Disturbances

Activity	CO tons	NO_X tons	PM_{10} tons	$PM_{2.5}$ tons	SO_2 tons	VOC tons	Total HAP tons	CO_2e tons
Construction	--	--	2.51	0.28	--	--	--	--
Transportation	3.16	1.76	0.05	0.05	0.00	0.30	0.04	324.37
Total	3.16	1.76	2.56	0.33	0.00	0.30	0.04	324.37

Emissions from Underground Mining Operations

For underground mining operations, direct and indirect air emissions associated with the Proposed Action would include CO_2, CO_2e, NO_2, $PM_{2.5}$, PM_{10}, SO_2, lead, and VOC, sulfuric acid (regulated by the State of Missouri), and the hazardous air pollutants (HAPs) arsenic, cadmium, lead compounds, and nickel. Direct emissions would be generated by the use of mining equipment, conveyors, milling equipment, material and tailing storage, and water processing facilities. Indirect emissions would be generated during the transportation and refining of the mined materials in varying rates depending on the quantity and purity of the minerals mined, quantity of recycled materials in the secondary materials market, and mineral commodity market prices.

Since the Proposed Action would allow for continued mining at or below existing production rates, air pollutant emissions are not expected to increase above the current permit allowable emissions rates in Table 3-1 (MoDNR 2013a, 2014, 2013b). Mining ores with a higher lead concentration or increasing the processing capacity of the existing equipment would increase lead emissions, both of which would require a modification to the existing air permits for the mines.

Indirect emissions are generated from the transport and smelting (refining) of minerals recovered from the mines. Since there are no primary lead smelters in the U.S. as of December 31, 2013, any emissions from smelting activities will not occur within the U.S. (EPA 2010). Instead, lead ore is transported via truck to Cape Girardeau, Missouri and loaded onto barges for transport to New Orleans, Louisiana, then transferred to an ocean cargo carrier for transport to primary lead smelters in Europe and Asia (Missouri Business 2015). Indirect emissions associated with transporting the minerals for processing generated by the expansion of the lead mining operations are estimated in Table 3-6. The air pollutant and GHG emissions associated with transporting the minerals overseas would primarily occur outside of the U.S., in international waters. These emissions were included in this analysis, as they are solely generated due to the mining activities associated with these leases.

Table 3-6. Indirect Air Pollutant and GHG Emissions from Ore Transportation

Source	CO tons	NO_X tons	PM_{10} tons	$PM_{2.5}$ tons	SO_2 tons	VOC tons	Total HAP tons	CO_2e tons
Ore Truck Emissions	6.30	15.84	0.59	0.58	0.01	1.05	0.21	989
Ore River Emissions	19.50	113.31	1.89	1.83	0.07	2.26	0.29	7,709
Ore Ocean Emissions	47.72	572.70	8.10	7.45	17.39	22.84	2.65	28,901
Total	**73.52**	**701.85**	**10.58**	**9.86**	**17.47**	**26.15**	**3.15**	**37,599**

The increases in direct and indirect emissions from the Proposed Action are estimated by extending current existing emissions from the lead mining, processing, and transportation operations. The emissions increases will not be increases to current emissions; rather, they reflect the length of time that emissions will be generated, due to the expansion of the lease areas.

Monetized Impacts from GHGs

In accordance with IWG recommendations provided in Section 3.2.1.4, this subsection provides estimates of the monetary value of changes in GHG emissions that could result from implementation of the Proposed Action. Such analysis should not be construed to mean a cost determination is necessary to address potential impacts of GHGs associated with the Proposed Action. These numbers were monetized; however, they do not constitute a complete cost-benefit analysis, nor do the SC-GHG numbers present a direct comparison with other impacts analyzed in this document. SC-GHG is provided only as a useful measure of the benefits of GHG emissions reductions to inform agency decision-making.

The SC-GHGs associated with estimated emissions from three lease modifications that would continue current production rates of lead, zinc, and copper at the Brushy Creek Mine, Fletcher Mine, and Sweetwater Mine were estimated using the direct and indirect GHG emissions information provided in Tables 3-5 and 3-6. The SC-GHG estimates presented in Table 3-7 represent the present value of future market and nonmarket costs associated with CO_2, CH_4, and N_2O emissions. Estimates are calculated based on IWG estimates of social cost per metric ton of emissions for a given emissions year and the BLM's estimates of emissions in each year and are rounded to the nearest $1,000.

Table 3-7. SC-GHGs Associated with Future Potential Development (2020$)

	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate
Total	$4,568,000	$16,821,000	$25,326,000

3.3. Geology

3.3.1. Affected Environment

3.3.1.1. Regional Geology

The Project Area is located within the Interior Highlands of the Ozark Plateau physiographic region, which includes the Salem Plateau underlain by rocks of Cambrian and Precambrian age.

At the time of late Cambrian sedimentation, a Precambrian granite basement high existed with an erosional surface of up to several hundred feet of relief. This eroded surface constituted a broad island, which was surrounded by smaller knobs and ridges of granite. The earliest sedimentary unit deposited was the Lamotte sandstone, a clastic, locally arkosic sequence that generally pinches out against the Precambrian granites forming the basement rocks of the St. Francois uplift (Kansas Geological Survey 2010). The thickness of the Lamotte sandstone varies from 0 to 500 feet, depending on the location with regard to the pinch out. The Lamotte sandstone is locally mineralized but is generally only a minor host for base metal mineralization. The Lamotte

sandstone is overlain by the Bonneterre formation composed of dolomite, sandy dolomite, and occasional thin shale units. The Bonneterre also pinches out against the higher part of the Precambrian core of the uplift and overlaps some of the lower outlying knobs and ridges. The Bonneterre ranges up to approximately 300 feet thick. The lower sequence contains abundant stromatolitic reefs and algal mats fringing the Precambrian basement. An upper sequence was deposited in a carbonate shelf environment. A large amount of the state's lead has been mined from the Bonneterre formation (Washington University of St. Louis 2020).

The Bonneterre is overlain, with possible local disconformity, by the Davis formation. The Davis formation consists of dolomitic, thin bedded shale. The Davis formation likely acted as an impermeable barrier to mineralizing fluids during the deposit formation. Above the Davis formation, a sequence of generally unmineralized dolomites comprises much of the remainder of the Cambrian stratigraphy (Doe Run 2016).

A limited number of major tectonic structures generally have northwest trends with lesser development of northeast trends. The Cub Creek and Palmer faults are major structures on the north end of the Viburnum Trend and mark the northern limit of ore grade mineralization. The Ellington fault south of the Sweetwater Mine marks the southern known boundary of the trend. The related Sweetwater fault down-drops the mineralized zone in the south part of the Sweetwater Mine. Seismic activity in this region of Missouri has been sporadic, relatively widespread, and historically of low magnitudes (Weary, et al. 2014)

The details of the genesis of the southeast Missouri base metal deposits have been a subject of discussion in the geologic community for years. The algal reef and back reef environment likely accumulated organic matter producing a reducing environment with available sulfur. The dolomitization of the limestone created a decrease in rock volume producing secondary permeability and open space which locally advanced to the point of forming breccia zones. Metal bearing groundwater expelled from the surrounding basins during stratigraphic compaction reacted with the sulfur in the open space in the upper Bonneterre carbonate sequence and resulted in the precipitation of lead, zinc, and copper sulfides along with minor silver, nickel, and cobalt to create ore grade mineral deposits. Mineralization is known to exist in all rock formations within the Viburnum Trend but is generally not in economic quantity to support mining activities (Doe Run 2016).

3.3.1.2. Local Geology

The Viburnum Trend base metal mineralization occurs as open space fillings in a dolomitized carbonate sequence of the Cambrian Bonneterre formation. Mineralization within the Viburnum Trend occurs almost continuously along a 35- to 40-mile length, and over widths of a few hundred to several thousand feet, with a thickness of a few feet to several tens of feet. The lower part of the Bonneterre formation consists of the algal stromatolitic reefs with a digitate morphology that are usually well developed. The back reef intertidal zone is commonly composed of dolomite and dolomitic mudstones with abundant planar stromatolites. This zone is commonly known as the white rock unit when exposed in the mines. The fore reef zone is composed of grainstone, carbonates, and calcareous mudstone. The main reef complex is overlain by an upper Bonneterre formation sequence of dolomite, oolitic dolomite, sandy dolomite and occasional lenses of shale and siltstone that developed as a sequence of shelf carbonates above the reef zone. These upper units are the principal hosts for base metal mineralization in much of the Viburnum Trend. The majority of the carbonate material within

and adjacent to the reefs is now dolomite. A few miles to the west, in the deeper part of the basin, the Bonneterre formation consists almost entirely of limestone (Doe Run 2016).

This geological setting with many local variations in deposit character is common through the Viburnum Trend. The majority of the base metal mineralization occurs as disseminated to massive sulfides following fractures, bedding features, sedimentary structures and breccia zones in the calcarenites of the upper part of the Bonneterre formation. The main mass of the reef is seldom mineralized to any extent, except in the northern part of the Viburnum Trend. The dominant sulfide in all the deposits is galena, with subordinate amounts of sphalerite, chalcopyrite, pyrite, and marcasite. The mineralization also contains varying amounts of silver, nickel, cobalt, and cadmium, both in solid solution in the dominant sulfides and as discrete mineral phases. Zinc is the primary element recovered from sphalerite. Copper mineralization tends to occur in separate zones, with variable lead and zinc content. Average mine grades are around 5% lead, 1% zinc, with copper zones averaging around 2% copper when present (Doe Run 2016).

3.3.1.3. Karst

The Project Area is located in a region of the Ozarks typified by what is called "karst topography," meaning that the geologic structures beneath the Earth’s surface are made of soluble limestone and dolomite. Karst features are caused by dissolution of carbonate rocks and deep weathering along prevailing fractures and strike-oriented bedding, creating conduits and voids (open and/or clay-filled). The presence of karst usually is indicated by the occurrence of distinctive physiographic features that develop as a result of the dissolution of soluble bedrock, such as limestone or dolomites in the Ozarks. These rocks are dissolved by water to form physiographic features that may include sinkholes, sinking (or disappearing) streams, caves, and karst springs. According to the U.S. Geological Survey (USGS) (2020), most of southern Missouri has carbonate (limestone) bedrock that can become karstified.

In karst areas, there is considerable water flowing into and through the subsurface of the land. Karst hydrogeology is typified by a network of interconnected fissures, fractures and conduits emplaced in a relatively low-permeability rock matrix. Most of the groundwater flow and transport occurs through the network of openings, while most of the groundwater storage occurs in the matrix. As a result, most karst aquifers are highly heterogeneous and anisotropic (USGS 2021).

Sinkholes (sinks) are naturally occurring depressions on the surface of landscapes that are the result of the dissolution or erosion of rocks below, the collapse or subsidence of voids below the surface or a combination of solution and collapse. Water falls as rain into sinks, or flows into sinks, then moves downward through soil and rock layers, governed by gravitational pull. It finds the water table or a subsurface water conduit where it can then flow laterally to eventually return to the surface as a spring, also known as a resurgence. MoDNR has recorded sinkholes in both Shannon and Reynolds counties (MoDNR 2022b) and the USGS has also mapped sinkhole hotspots in Shannon County (USGS 2020).

3.3.2. Environmental Impacts

3.3.2.1. Impacts of Alternative A – No Action Alternative

Under the No Action Alternative, the BLM would not approve the three proposed lease modifications. Doe Run would not conduct any additional surface exploration, underground mining, or other activities described in the Proposed Action that could affect geologic resources in the Project Area. Current mining operations would continue on existing Doe Run-leased lands. Selection of the No Action Alternative would have no impact on geologic resources in the Project Area.

3.3.2.2. Impacts of Alternative B – Proposed Action

Surface Exploration Drilling

Within the Project Area, an initial surface drilling exploration campaign of approximately 61 surface drill sites is anticipated. The density and distribution of drill holes would vary annually based on exploration priorities and minerals discovered during drilling within both current and proposed lease areas.

Proposed exploration drilling would core from the surface and penetrate the underlying rock formations to include the Potosi, Derby Doe-Run, Davis, Bonneterre, and the upper 20 feet of the LaMotte, and/or the upper 10 feet of the Precambrian formation. The total depth of the holes would range from 1,300 feet bgs for a standard drill hole to 3,200 feet bgs for Precambrian drilling.

Impacts to geologic resources due to surface exploration drilling under the Proposed Action would be temporary and minor as they would be limited to the location of the drilling core, or surface area disturbed by drilling. Doe Run would restore the disturbed area to its approximate pre-drilling condition. Upon completion of activity at each drill hole, Doe Run would plug each hole in accordance with MoDNR standards in 10 CSR 23-6.050 and fill it with clean backfill material to stabilize and prevent it from collapsing or sloughing. The plug also reduces the risk of ground water saturation in the overburden, thus reducing the likelihood of overburden collapse and formation of a sinkhole. Therefore, there would be no long-term impacts to geologic resources from surface exploration drilling under the Proposed Action.

Mine Operations

Under the Proposed Action, ongoing Doe Run mine operations would extend into the Project Area and would be conducted underground utilizing the mechanized room and pillar method in compliance with the current Operating Plan on file with the BLM. As described in Section 2.2.3, Doe Run utilizes environmental protection design features to promote long-term stability of the area and minimize or prevent widescale subsidence. Span pillars would be placed for support as required to minimize the likelihood of pillar failures. Multiple span pillars may be left following mining to minimize the size of open stopes (underground areas unsupported by pillars), decreasing the likelihood of significant backfalls. Once a final extraction plan is determined, visual ratings would be taken of key pillars in the extraction area to calibrate the numerical stress model. Modelling would be performed for each sequence of the extraction plan and key pillars would be monitored after completion of each sequence so that proper amendments to sequencing

and/or span pillar placement can be made if necessary to ensure the long-term stability of the back of the mined area and the stope.

As described in Section 3.3.1.3, karst features, including sinkholes of various sizes, are naturally occurring features along the Viburnum Trend. A sinkhole did previously occur within land currently leased by Doe Run at the West Fork Mine in Reynolds County in 2014. Underground mining activities do present the potential risk of sinkholes and other subsidence events; however, events such as that which occurred at the West Fork Mine are considered uncommon. Doe Run and the BLM and USFS have sinkhole monitoring systems in place. Additionally, Doe Run implements design features in mining operations to prevent widescale collapse. Therefore, given the low historical frequency of sinkholes in Doe Run's lease areas in addition to monitoring efforts and the use of internal and external controls by Doe Run and the BLM and USFS, the risk of a severe subsidence event is low. As the nearest residence is at least 0.1 miles away from the boundary of any of the Modified Lands, no impacts to the structural integrity of nearby residences and other structures are expected.

Historical data shows no record of human-induced earthquakes from mining in the Viburnum Trend (Wilson et al. 2017, Foulger et al. 2018). The time-tested methods proposed to be used by Doe Run for exploration drilling and mining, in conjunction with the competency of the geological strata in the Project Area, the potential for seismic activity from the Proposed Action is considered to be negligible.

3.4. Soils

3.4.1. Affected Environment

As shown on a soil survey conducted by the Natural Resources Conservation Service (NRCS), there are 16 soil map units (MUs), or collections of areas defined and named the same in terms of their soil components (or series), located within the Project Area (NRCS 2022). The Clarksville-Scholten complex, 15-45% slopes, very stony, MU comprises the largest percentage of area in the total Project Area (approximately 41%), which reflects the hilly and rocky topography of the region.

Each mapped soil unit within each of the proposed Modification Lands and their properties are summarized in Tables C-1 through C-3 in Appendix C. In general, management issues for each type of soil are related to soil suitability and limitations with respect to proposed uses. The soil ratings listed below were obtained from the NRCS and professional judgement and can be used to determine the potential need for BMPs related to soil management, including erosion and sediment control measures.

1. Drainage class identifies the natural drainage conditions of the soil and refers to the frequency and duration of wet periods (wet soil conditions) (e.g., well-drained).
2. Erosion hazard – indicates the potential for hazards caused by soil loss from unpaved roads and trails. Erosion hazard ratings are based on soil erosion potential (K factor), slope, and content of rock fragments in the soil. The ratings are Slight, to indicate little or no erosion is likely; Moderate, to indicate some erosion is likely and basic erosion control measures (i.e., BMPs) are needed; and Severe, to indicate that significant erosion is expected and erosion control BMPs are required.

3. Runoff class – Characterizes the water that flows off the land surface that does not enter (infiltrate) the soil. Runoff class ratings are described as Low, indicating that a small portion of rainfall will be conducted as surface runoff, that infiltration is quick, and that the soil water storage is adequate. Medium indicates that a moderate portion of rainfall will be conducted as surface runoff, and High indicates that rainfall is readily conducted as surface runoff with little and slow infiltration into the soil.
4. Rutting hazard – Indicates the potential for hazards caused by rutting, which occurs when soil strength is not sufficient to support applied loads from the operation of equipment in forested areas. Soil displacement, puddling, compaction, and deformation may occur along with rutting. Ratings are based on water table depth, soil class, rock fragment content, depth to a restrictive layer, and slope. A rating of Slight indicates little to no rutting potential, Moderate indicates rutting is likely, and Severe indicates that ruts form readily.
5. Mechanical site preparation – Indicates the suitability for use of soil-altering soil tillage equipment during site preparation in forested areas. Although tillage equipment is not likely to be used in the construction of the surface drill sites, this rating is informative as to the suitability of the soil at the site for shallow excavation. Mechanical site preparation ratings are based on slope, depth to restrictive layer, rock fragment content, plasticity index, water table depth, and ponding. Ratings are described as Well suited, to indicate that the soil has favorable properties for the specified kind of site preparation and no limitations. Poorly suited indicates that the soil has unfavorable properties for the specified kind of site preparation and will require special design and maintenance. Unsuitable indicates that unacceptable soil performance is expected for the specified kind of site preparation or extreme measures are needed to overcome the unfavorable soil properties.
6. Road suitability – Indicates the suitability of the natural soil surface for road development. This rating is based on slope, rock fragment content, plasticity index, sand content, soil classification, water table depth, ponding and flooding frequency, and soil slippage. Ratings range from Well suited, to indicate that the soil has favorable properties for the specified road types and no limitations; Moderately suited, indicating that the soil is moderately favorable for the road type specified; and Poorly suited, which indicates that the soil has unfavorable properties for the specified types of roads and will require special design and maintenance.

3.4.1.1. Fletcher Mine

The two proposed lease modification parcels at the Fletcher Mine consist of 13 soil MUs with Clarksville-Scholten complex, 15-45% slopes, very stony comprising approximately 44% of the two parcels (Table C-1). Clarksville soils, which compose 50% of the Clarksville-Scholten complex MU, are found on steep side slopes and narrow ridgetops. These soils are very deep and derived from hillslope sediments. Scholten soils compose 30% of the Clarksville-Scholten complex MU and are found on slopes and ridges of rolling landscapes at the heads of drains. These soils are very deep and were formed in colluvium and underlying residuum (NRCS 2022).

The next most abundant soil MU is the Poynor-Clarksville-Scholten complex, 8-15% slopes, stony MU, which covers about 16% of the two parcels. Poynor soils compose 35% of this MU