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Environmental Assessment

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**September 2019 Competitive
Geothermal Lease Sale EA**

PREPARING OFFICE

U.S. Department of the Interior
Bureau of Land Management
Battle Mountain District,
Nevada



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Chapter 1. Introduction

1.1 Background and Summary

The Bureau of Land Management (BLM) Battle Mountain District (BMD) office encompasses about 13.5 million acres, of which approximately 10.4 million acres are public lands managed by the BLM. The BLM is considering offering up to eight parcels, comprising about 7,590.50 acres of land within the area administered by the BMD, in a multi-state competitive Geothermal Lease Sale to be held in September, 2019. These nominated parcels amount to less than 0.1 percent of public lands in the BMD.

A legal land description of the parcels is provided in Appendix A; maps of the general location of the parcels and their ownership status are included in Appendix B.

A geothermal lease is created for the use of the earth's heat resource on lands with federal mineral estate. Geothermal resources are underground reservoirs of hot water or steam created by heat from the earth. Geothermal steam and hot water can reach the surface of the earth in the form of hot springs, geysers, mud pots, or steam vents or may be confined at depth with no surface expression at all. These resources can be accessed by wells and the heat energy can be used for generating electricity or other direct uses, such as heating homes, water, greenhouses and aquaculture operations or for dehydrating vegetables. Geothermal resources on federal lands are subject to lease under the Geothermal Steam Act of 1970, as amended (30 USC § 1001, et seq.), and geothermal resource leasing regulations (43 CFR §3200).

Developing geothermal resources on public land involves four phases: leasing, exploration, development/operation and close-out. The first phase is to issue a lease. Leasing of geothermal resources confers an implied right to the lessee to explore and develop the geothermal resource. The act of leasing does not directly result in surface disturbance activities; however ground disturbance would occur during the second and third phases, exploration and development. Phase four, close-out, would involve removing facilities and reclaiming the site.

In preparing a lease sale the NVSO sends a list of land parcels, based on land nominated by the public, to the district where the parcels are located. As part of the Environmental Assessment (EA), in conformance with the National Environmental Policy Act (NEPA), the district staff reviews the parcels to determine:

- if they are in areas open to leasing, according to the applicable approved RMP;
- current best available scientific information for resources on the parcels;
- what consultations should be conducted;
- what resource-protective stipulations, if any, should be attached to each parcel; and
- if there are special resource conditions and applicable existing laws of which potential bidders should be made aware, via lease notices.

The EA verifies conformance with the approved RMPs and provides the rationale for any stipulations or lease notices applied to specific parcels. An interdisciplinary team (ID Team) of resource specialists considered historical data, existing databases, file information and personal knowledge of the areas involved to assess potential environmental effects and identify appropriate stipulations and lease notices.

At the time of this review it is not known whether the nominated parcels will receive bids, if leases would be issued, or what types of lease operations might be proposed in the future, if any. An additional, more detailed project and site-specific analysis of individual wells, roads, or development plans would occur when a Geothermal Drilling Permit (GDP) or other exploration or development plan is submitted.

1.2 Purpose and Need for Action, and Decision to be Made

The purpose of the Proposed Action is to lease and facilitate development of geothermal resources where appropriate, consistent with the Energy Act of 2005 and related policies, and in a manner that will promote use of clean technology and prevent unnecessary or undue degradation of public lands, resources, and uses.

The need for the Proposed Action is for the BLM to respond to the public interest in leasing geothermal resources as directed by the Geothermal Steam Act of 1970, as amended and EO 13212 as amended by EO 13302, Actions to Expedite Energy-Related Projects, which states “the increased production and transmission of energy in a safe and environmentally sound manner is essential.” Executive departments and agencies are directed to “take appropriate actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy.”

EO 13212 further states that “(f)or energy-related projects, agencies shall expedite their review of permits or take other actions as necessary to accelerate the completion of such projects, while maintaining safety, public health, and environmental protections. The agencies shall take such actions to the extent permitted by law and regulation, and where appropriate.” In response to the EO 13212, BLM issued a National Energy Policy Implementation Plan in June 2001, which directs the BLM to process leases, in a timely manner, in order to help support efforts to increase energy production from federal lands, while preserving the health of the federal lands. Further the Energy Policy Act of 2005 (Public Law 109-58) identifies the need for greater energy security and is directed towards a reduced dependence on foreign energy sources, and it also emphasizes the need to upgrade the energy infrastructure by upgrading and modernizing the energy grid to meet the needs of a growing economy and population. The Advanced Energy Initiative, derived from the Act, is directed towards increasing the generation and use of alternative fuels and clean energy technology, including solar, wind, and geothermal energy sources.

This action is being initiated to facilitate Battle Mountain District’s implementation of the requirements in Executive Order (EO) 13212 (2001) and the National Energy Policy Act (2005). The BLM is required by law to consider leasing of nominated areas if leasing is in conformance with the applicable BLM land use plan. The Districts must provide a recommendation to the Nevada BLM State Director who will decide which parcels will be included in the upcoming September 2019 Competitive Geothermal Lease Sale, and which stipulations will be applied, based on the analysis in this EA.

1.3 Land Use Plan Conformance

FLPMA directs the BLM to develop and maintain comprehensive Resource Management Plans (RMPs) that govern all aspects of public land management, and that proposed leasing activities conform to approved RMPs. This EA tiers to the environmental impact statements (EISs) 2008 Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States (Geothermal

PEIS), (BLM and USFS, 2008). The Proposed Action is in conformance with the Tonopah RMP and Shoshone Eureka (Mt. Lewis) RMP, their associated Records of Decision, and all subsequent applicable amendments. Each RMP addresses land use goals and objectives, allowable uses and management actions for the respective field office.

Tonopah RMP (Tonopah Field Office), approved 1997

Fluid Minerals Objective: “To provide opportunity for exploration and development of fluid minerals such as oil, gas, and geothermal resources, using appropriate stipulations to allow for the preservation and enhancement of fragile and unique resources” (p.22).

It has been determined that the nominated lease parcels are a subset of “[The] total of 5,360,477 acres (88% of the Tonopah Field Office area)[that] is open to fluid minerals leasing subject to standard terms and conditions” (RMP p.22). The RMP and parcel list have been reviewed for applicability of RMP decisions imposing restrictions on fluid minerals activities.

Shoshone Eureka RMP (Mt. Lewis Field Office), approved 1986

The Proposed Action is in conformance with the Shoshone Eureka RMP Part II, Section E, Management Actions Not Expressly Addressed by the Resource Management Plan, which includes Minerals Objectives and Management Decisions brought forward unaltered from the Management Framework Plan (Record of Decision p. 29). Minerals Objectives 1, 2 and 3 led to Management Decisions 1 through 5 for leasable minerals (geothermal). The objectives are as follows:

- Objective 1: Make available and encourage development of mineral resources to meet national, regional and local needs consistent with national objectives for an adequate supply of minerals.
- Objective 2: Assure that mineral exploration, development and extraction are carried out in such a way as to minimize environmental and other resource damage and to provide, where legally possible, for the rehabilitation of lands.
- Objective 3: Develop detailed mineral resource data in areas where different resources conflict so that informed decisions may be made that result in optimum use of the lands.

Management Decision #2 states, “All areas designated by the BLM as prospectively valuable for geothermal steam will be open for exploration and development unless withdrawn or restricted from mineral entry. All public lands disposed of in these areas will have the geothermal resources reserved to the federal government.” The RMP has been reviewed for modifications by other resources; none were identified for the nominated parcels.

Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States, 2008

The Proposed Action is in conformance with the Record of Decision (ROD) from the Programmatic Environmental Impact Statement for *Geothermal Leasing in the Western United States*, signed on December 17, 2008. This document amended and updated existing BLM RMPs and provided for the consistent mitigation of fluid minerals operations by federal land management agencies. Additionally, the PEIS identified lands that are administratively and legally closed or open to leasing and under what conditions, developed a consolidated and updated list of stipulations, best management practices, and procedures to serve as consistent guidance for geothermal leasing and development on public and

National Forest Service lands, and provided a reasonably foreseeable development scenario for geothermal development on Federal land.

Greater Sage-Grouse Record of Decision and Approved Resource Management Plan Amendment (ROD and ARMPA), approved 2019 and Nevada and Northeastern California Greater Sage-Grouse Approved Resource Management Plan Amendment, approved 2015

The Proposed Action and alternative are in conformance with the 2019 *Nevada and Northeastern California Greater Sage-Grouse Record of Decision and Approved Resource Management Plan Amendment* (ROD and ARMPA) which amends several BLM land use plans including the Tonopah, Shoshone-Eureka, and Ely District RMPs. The ROD and ARMPA guide management of Greater Sage-Grouse habitat on BLM managed lands in Nevada and northeastern California to align with the State of Nevada's Greater Sage-Grouse Conservation Plan and conservation strategies implemented by the California Department of Fish and Wildlife. The ARMPA builds upon the 2015 *Nevada and Northeastern California Greater Sage-Grouse Approved Resource Management Plan Amendment* and does not modify all decisions of this plan.

Following the 2019 ROD and ARMPA, this objective is developed:

“Where a proposed fluid mineral development project on an existing lease could adversely affect GRSG populations or habitat, the BLM will work with the lessees, operators, or other project proponents to avoid, reduce and mitigate adverse impacts to the extent compatible with lessees' rights to drill and produce fluid mineral resources. The BLM will work with the lessee, operator, or project proponent in developing an Geothermal Drilling Permit (APD) for the lease to avoid and minimize impacts on GRSG or its habitat and will ensure that the best information about GRSG and its habitat informs and helps to guide development of such federal leases.”

The act of leasing does not directly result in surface disturbance activities. Future site-specific geothermal development activities in the planning area are implementation-level decisions. Upon receipt of an application for these types of projects, the BLM would require a site-specific environmental analysis before ground-disturbing actions could be approved. Specific impacts of such actions would be analyzed at that time, along with the identification of possible mitigation measures. Site-specific environmental analysis would include the opportunity for additional public participation and coordination with county and state land and resource managers. Proposed site-specific activities would also be required to comply with other laws and regulations. In this EA, we can make some general assumptions about what type of activities could occur on geothermal leases, and provide general analysis of potential impacts associated with those types of activities.

1.4 Relationship to Statutes, Regulations and Policy

The Proposed Action is in conformance with the NEPA of 1969 (P.L. 91-190 as amended; 42 USC §4321 et seq.); the Mineral Leasing Act of 1920 as amended and supplemented (30 USC 181 et seq.); the Federal Geothermal Leasing Reform Act of 1987, with regulatory authority under 43 CFR Part 3100, Onshore Geothermal Leasing and 43 CFR Part 3160, Onshore Geothermal Operations; and Title V of the FLPMA of 1976, Rights-of-Way (ROW), with regulatory authority under 43 CFR Part 2800, ROW. Purchasers of geothermal leases are required to abide by all applicable federal, state and local laws and

regulations. This includes obtaining all required permits if they develop the lease. All activities will be subject to regulations including, but not limited to, the following.

Bald and Golden Eagle Protection Act (BGEPA) (16 U.S.C. 668) prohibits the direct or indirect take of an eagle, eagle part or product, nest, or egg. The term “take” includes “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb.” The U.S. Fish and Wildlife Service (USFWS) has provided guidance for proposed projects that have the potential to impact eagles or their habitat; BLM biologists and USFWS would address potential impacts at the time of additional project-specific analysis.

BLM and Nevada Department of Wildlife (NDOW) Memorandum of Understanding (MOU) directs the agencies’ cooperative management of wildlife and fish resources and their habitat on public lands, as established in 1971. The BLM meets its obligations under the MOU by managing public lands to protect and enhance food, shelter and breeding areas for wild animals.

BLM Special Status Species (SSS) are designated by the State Director for each state and are defined as those plant and animal species for which population viability is a concern, as evidenced by a significant current or predicted downward trend in population numbers or density, or in habitat capability that would reduce the species’ existing distribution. BLM manages SSS habitats so as to promote their continuing viability. BLM Manual 6840, Special Status Species Management provides additional guidance.

Clean Air Act of 1970, as amended and supplemented by subsequent legislation, established air quality standards to protect health and public welfare and to regulate emissions of hazardous air pollutants.

Clean Water Act of 1972 provides extensive direction regarding the degradation of water sources. The Clean Water Act originally applied to “navigable waters”; the United States Supreme Court determined in the 2006 case *Rapanos v. United States* that it also held for “waters of the United States,” defined as “including only those relatively permanent, standing or continuously flowing bodies of water forming geographic features” that are described as “streams[,] ... oceans, rivers, [and] lakes.”

Endangered Species Act (ESA) of 1973, Section 7(a)(2), states that “Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affect States, to be critical....”

Energy Policy Act of 2005, which is directed towards a reduced dependence on foreign energy sources and encourages the development of alternative energy.

Executive Order (EO) 11988 –instructs all federal agencies to avoid development in a floodplain whenever possible; ***EO 13690*** provides further instruction, along with FEMA guidelines for implementing both (FEMA 2015).

Executive Order (EO) 11990 – Protection of wetlands tells agencies to “minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands” and instructs, “when Federally-owned wetlands or portions of wetlands are proposed for lease, easement, right-of-way or disposal to non-Federal public or private parties, the Federal agency shall (a) reference in the conveyance those uses that are restricted under identified Federal, State or local wetlands regulations;

and (b) attach other appropriate restrictions to the uses of properties by the grantee or purchaser and any successor, except where prohibited by law; or (c) withhold such properties from disposal.”

Executive Order (EO) 13212, which directs the Secretary of the Interior to expedite energy-related projects.

Federal Land Policy and Management Act of 1976, as amended, directs the Secretary of the Interior to manage the public lands for multiple use, and sustained yields.

Geothermal Steam Act of 1970 governs leasing of geothermal resources on public land and guides the BLM on leasing procedures.

Mineral Leasing Act of 1920, as amended and supplemented by subsequent legislation, provides for the authorization of BLM to administer leasing of public lands for leasable minerals.

National Historic Preservation Act (NHPA) Section 106 requires Federal agencies to take into account the effects of their undertakings on historic properties. The BLM also must comply with the Nevada State Historical Preservation Office (SHPO) protocol agreement, which is authorized by the National Programmatic Agreement between the BLM, the Advisory Council on Historic Preservation and the National Conference of State Historic Preservation Officers.

Safe Drinking Water Act is the federal law that protects public drinking water supplies throughout the nation. The U.S. Environmental Protection Agency (EPA) sets standards for drinking water quality and, with its partners, implements various technical and financial programs.

Secretarial Order 3289 addresses current and future impacts of climate change on America’s land, water, wildlife, cultural-heritage, and tribal resources,

Migratory Bird Treaty Act (MBTA) of 1918 protects migratory birds, with the exception of native resident game birds. Under this act, nests with eggs or the young of migratory birds may not be harmed, nor may any migratory birds be killed. ***EO 13186*** (2001) provided federal agencies with further direction to implement the MBTA.

Wild Free-Roaming Horse and Burro Act of 1971 (WFRHBA) directs the BLM’s responsibility for the protection, management and control of wild horses and burros “in a manner that is designed to achieve and maintain a thriving natural ecological balance on the public lands.” The BLM is mandated to manage wild horses and burros only within those areas on public lands where they were found in 1971 when the WFRHBA was passed. They cannot be relocated elsewhere in the District; new Herd Management Areas (HMAs) cannot be created; and BLM cannot expand the HMAs to replace habitat lost. Management guidance includes 43 CFR 4700 and the Wild Horses and Burros Management Handbook H-4700-1.

1.5 Scoping and Public Involvement

Native American Coordination: The Battle Mountain District initiated coordination regarding the proposed lease parcels with the Yomba Shoshone, Timbisha Shoshone, Battle Mountain Band of Western Shoshone, Duckwater Shoshone, South Fork Band of Western Shoshone, Elko Band of Western Shoshone, and Te-Moak Tribe of Western Shoshone tribes, via letters sent on 05/23/2019. Coordination

with the Tribes is always ongoing. If any lease parcel is later found to contain resources protected under the NHPA, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act, Executive Order 13007, or other statutes and executive orders, BLM will not approve ground-disturbing activities that may affect such resources until completing its tribal consultation obligations; and may require modification to exploration or development proposals or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized, or mitigated.

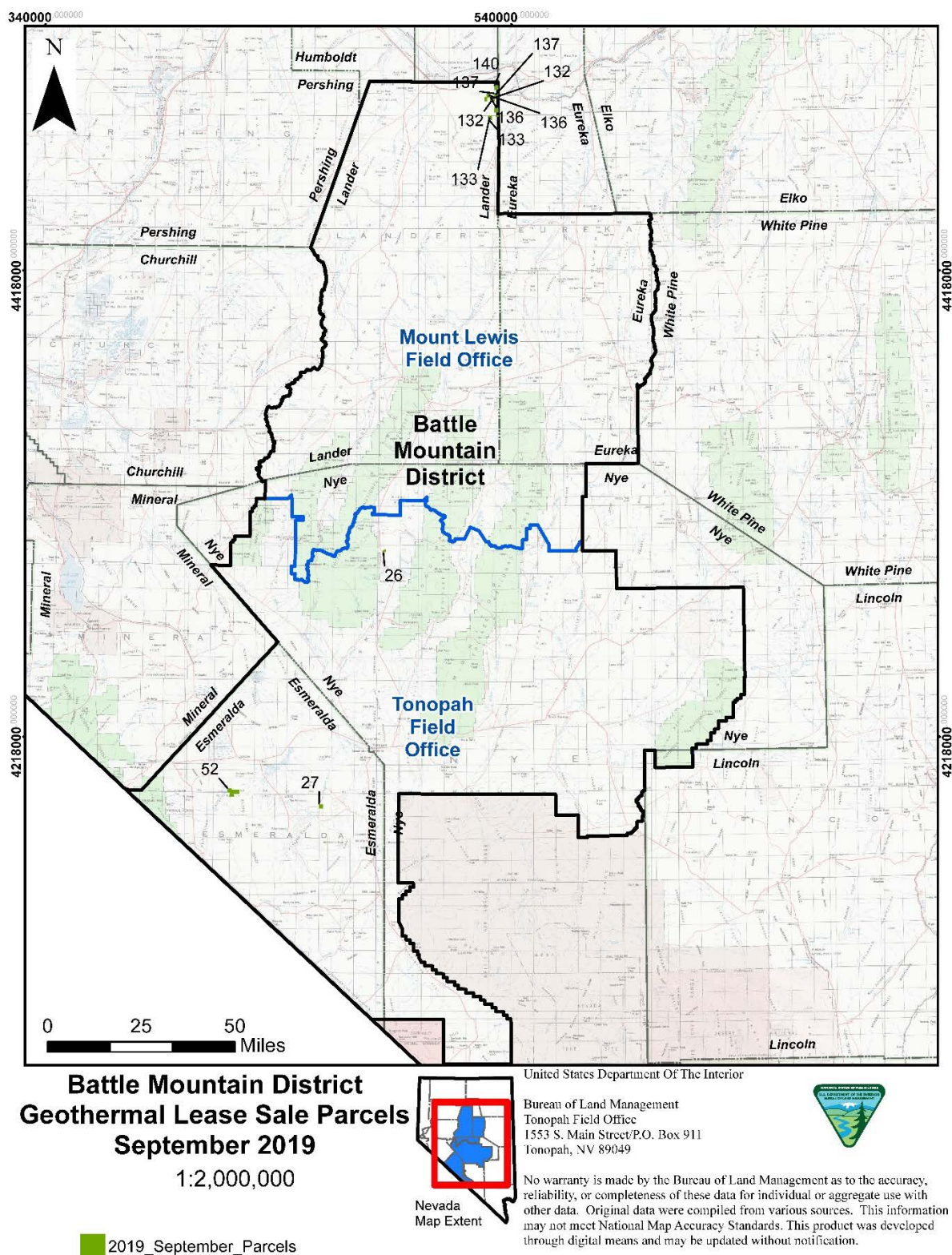


Figure 1. September 2019 Geothermal Lease Sale proposed parcels overview, Battle Mountain District (three parcels within Tonopah field office and five parcels in Mount Lewis field office).

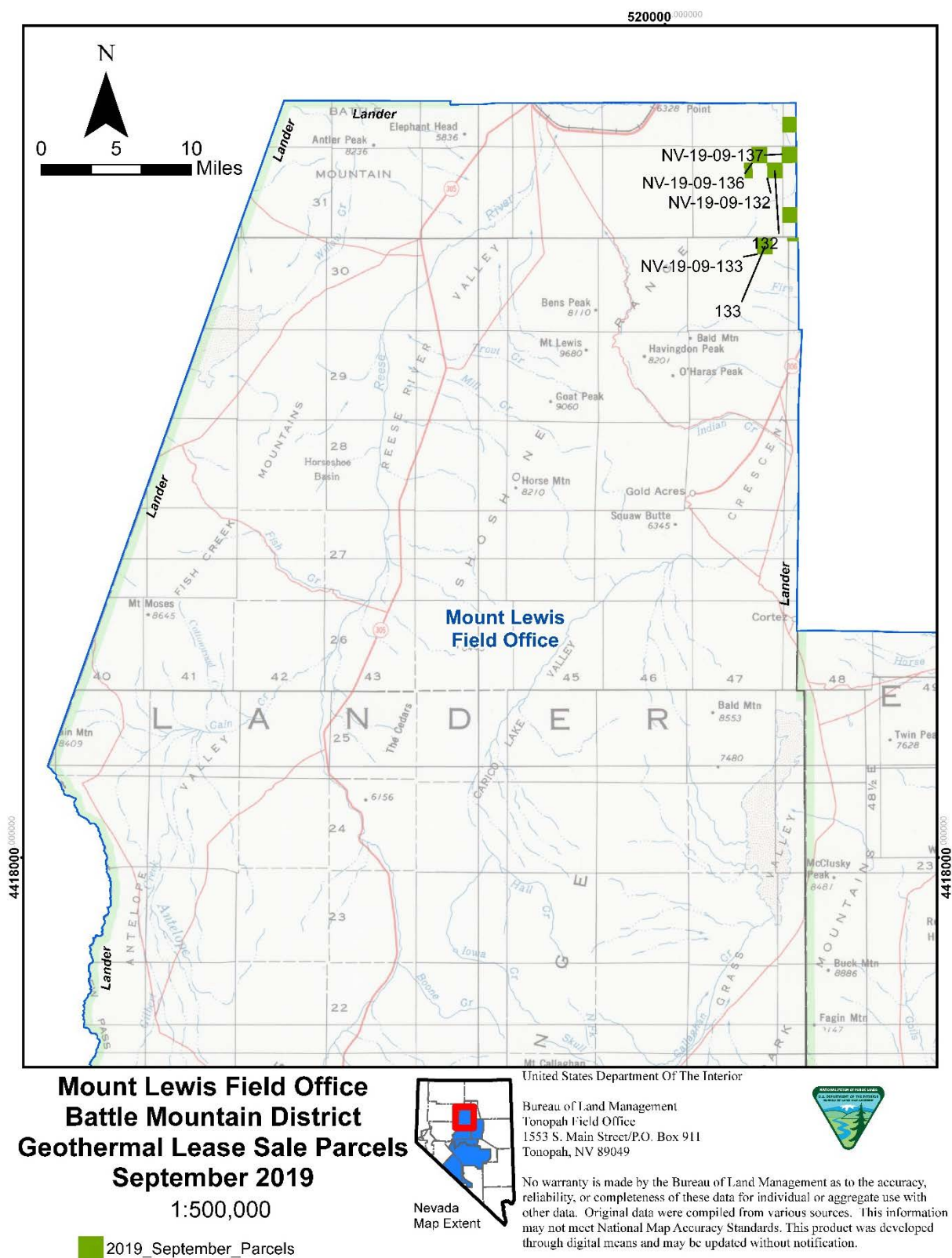


Figure 2. September 2019 Geothermal Lease Sale proposed parcels in Mount Lewis field office.

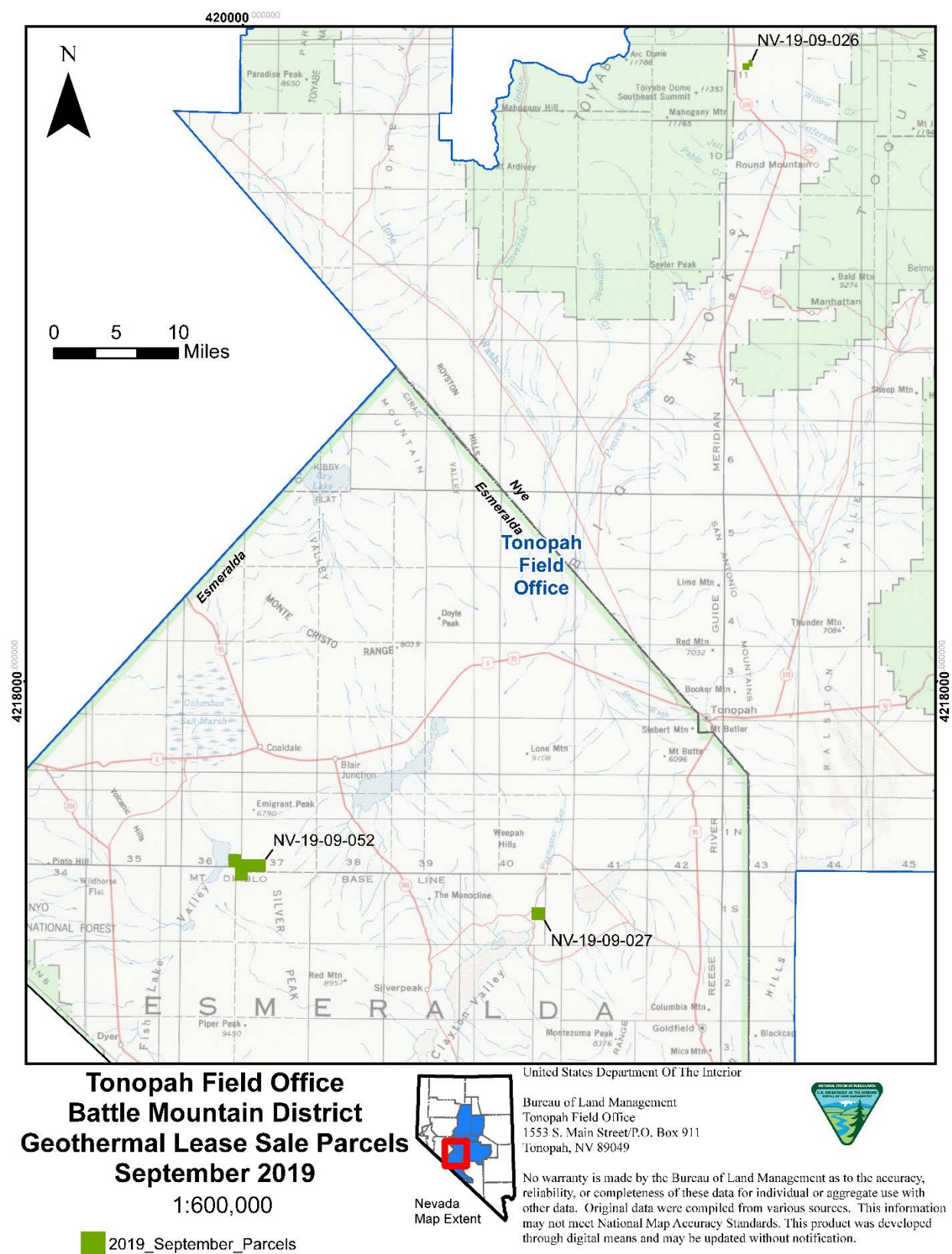


Figure 3 September 2019 Geothermal Lease Sale proposed parcels in Tonopah field office.

Chapter 2. Proposed Action and No Leasing Alternative

2.1 Description of the Proposed Action

The Proposed Action is to offer for competitive sale all of the eight nominated parcels that the BLM NVSO provided to Battle Mountain District for review. These eight parcels total approximately 7,590.50 acres in Big Smoky Valley, Clayton Valley, and Whirlwind Valley (overview maps, Figures 1 through 3; parcels in relation to topography; parcels in relation to land status, Figures 4-6 in Appendix K; legal land descriptions, Appendix A).

Geothermal leases are issued for a 10-year period and continue for as long thereafter as geothermal energy is produced. If a lessee fails to produce geothermal, does not make annual rental payments, does not comply with the terms and conditions of the lease, or relinquishes the lease; ownership of the minerals revert back to the federal government and the lease can be resold.

Lease notices and stipulations would be attached to each offered lease parcel; these are listed in Appendix B, with the parcels to which each stipulation would apply.

If leases are issued and lease operations are proposed in the future, BLM would conduct additional site-specific, project-specific NEPA analysis when a Geothermal Drilling Permit (GDP) or other exploration, development or production project application is submitted. In addition to the stipulations and notices attached to the parcel, conditions of approval and best management practices would be applied.

2.2 Description of the No Leasing Alternative

In accordance with BLM NEPA guidelines H-1790-1, Chapter 6, this EA evaluates a No Leasing Alternative. This alternative forms a baseline for assessing and comparing the potential impacts of the other alternatives. Under this alternative, no parcels in the BMD would be offered for lease sale in September 2019. Any new geothermal development would take place on parcels that were leased in other lease sales (33 authorized leases in Battle Mountain District at the time of this EA).

2.3 Resource Protection Lease Terms and Stipulations

Once a parcel is leased, the lessee has the right to explore for and develop geothermal resources, subject to standard lease terms and special stipulations pertaining to the conduct of operations. The conduct of operations by the lessee on all parcels would be subject to the following terms from the back of the standard lease form, which state:

“Conduct of Operations” (Form-3200-24a, Section 6)

Conduct of operations—Lessee must conduct operations in a manner that minimizes adverse impacts to the land, air, and water, to cultural, biological, visual, and other resources, and to other land uses or users. Lessee must take reasonable measures deemed necessary by lessor to accomplish the intent of this section. To the extent consistent with leased rights granted, such 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. Lessor reserves the right to continue existing uses and to authorize future

uses upon or in the leased lands, including the approval of easements or rights-of-way. Such uses will be conditioned so as to prevent unnecessary or unreasonable interference with rights of lessee. Prior to disturbing the surface of the leased lands, lessee must contact lessor to be apprised of procedures to be followed and modifications or reclamation measures that may be necessary. Areas to be disturbed may require inventories or special studies to determine the extent of impacts to other resources. Lessor may require lessee to complete minor inventories or short term special studies under guidelines provided by lessor. If, in the conduct of operations, threatened or endangered species, objects of historic or scientific interest, or substantial unanticipated environmental effects are observed, lessee must immediately contact lessor. Lessee must cease any operations that are likely to affect or take such species, or result in the modification, damage or destruction of such habitats or objects.”

See Appendix B for lease stipulations and parcels they apply to.

Chapter 3. Affected Environment and Environmental Consequences

3.1 Analysis Process Overview

Since there is no specific project proposal at the time of a lease sale, likely effects are predicted based on a Reasonable Foreseeable Development (RFD) scenario for the Battle Mountain District (see Appendix G). The scenario originates from the *1994 Tonopah Final Environmental Assessment* and includes information from the *2008 Geothermal Leasing in the Western United States Programmatic PEIS*, it also combines knowledge of activities within the district, with future expectations, and technological advances, as well as standard assumptions. The process used is summarized in this section. This section also identifies which resources may be affected. The ID Team considered all resources that various supplemental authorities require BLM to address in EAs, and others deemed appropriate for evaluation. If a resource is not present or would not be affected, the rationale is provided here and the resource is not discussed further.

3.1.1 Methods and Assumptions

A geothermal lease sale does not involve a specific project proposal, but rather is a first step in making certain lands available for future geothermal development; therefore, a meaningful analysis of the differences between alternatives requires that the Proposed Action include assumptions based on current exploration and development trends and projections. The assumptions used in this analysis include scenarios which predict the number of wells and amount of surface disturbance likely to occur (Appendix G, summarized below), and the assumption that current technologies, methods, and requirements will be applied in the foreseeable future.

Reasonably Foreseeable Development (RFD) Scenario Summary- Battle Mountain District

The surface disturbance estimate used to analyze the alternatives in this EA is based on the RFD scenario in Appendix G. Based on geothermal projects in the BMD, approximately 40 to 60 wells would be drilled and 50-200 acres of surface disturbance associated with geothermal well pads are expected for geothermal exploration drilling. Up to two small scale geothermal power plants (15-20 megawatts (MW)) are expected to be developed. Each facility will require 5-10 production, and 5-10 injection wells, between

2-4 miles of roads and pipelines, and 3-30 miles of transmission line. It is anticipated that the two power plants, roads, pipelines, and transmission lines would require up to 500 acres of surface disturbance.

Types of disturbance that could occur are assumed to be those associated with technologies currently in use in geologically similar areas, as described below; and would be limited by the stipulations applied.

Types of Activities Anticipated

At any point during the 10-year term of the lease, the lessee, or operator may submit specific plans for some level of proposed development. Typical geothermal development operations occur in phases, in a more or less predictable sequence that is contingent on the success or failure of the previous phase. This section discusses types of activities that may be anticipated based on current technology and trends, and that are therefore taken into account as potential causes of impacts in this EA's analysis of alternatives.

Geophysical Exploration is used to obtain detailed information about physical properties of the subsurface. A variety of methods are used, including placing electrodes or geophones in the ground; detonating explosives to create shockwaves; and using specially constructed off-road vehicles to produce vibrations. Currently, the most common method in eastern Nevada is the seismic vibrator technique: a large vehicle-mounted "thumper" or "shaker" generates a controlled vibration which is recorded by small, typically hand-placed sensors. This is repeated in a grid pattern across an area, and resulting seismogram readouts provide information about subsurface properties.

Exploration Drilling begins with drilling a temperature gradient well (TGW). TGW wells are typically small diameter holes and are used to determine temperature increase by depth. In order to drill a TGW, a GDP is filed with the BLM. A field examination is conducted and NEPA review is completed before a drilling permit can be approved. An access road and a well pad are constructed for each well, if needed. Total disturbance attributed to drilling a TGW is usually limited to 0.5 to 2.5 acres for the pad and access road.

Production and Injection Well Drilling typically occurs after a TGW indicates temperatures are sufficient to support geothermal fluids. A production well is typically drilled much deeper to a projected depth that is project to contain both temperature and volume of fluids needed to use in energy production. Injection wells are drilled to accept used geothermal fluids after use.

Well Stimulation and Hydraulic Fracturing (HF) may be used to enhance oil recovery once a well is successfully drilled. Several methods of well stimulation are common practice in today's industry. HF is one of these methods that are reasonably foreseeable for leases proposed for this sale. HF is the process of applying high pressure fluid to a subsurface formation via a wellbore, so that the pressurized fluid opens fractures in the rock. The opened fractures are propped open with a "proppant," a granular material (typically sand, treated sand or man-made ceramic materials), to enhance fluid connectivity between the wellbore and formation. The process can increase the yield of a well and enable production of geothermal from tight formations that would not otherwise be economically feasible to develop. The conventional HF process has been used routinely since 1950. HF is sometimes combined with horizontal drilling in which a drill hole is completed as a "lateral" parallel with the rock layer containing the fluid mineral to be extracted.

Please refer to the Hydraulic Fracturing Technology discussion (Appendix E) for more information. The State of Nevada has adopted hydraulic fracturing regulations which are more stringent than federal requirements, and would be applicable to any HF operation proposed in the state. These have been incorporated into the Nevada Revised Statutes (NRS 522, <https://www.leg.state.nv.us/NRS/NRS-522.html>) and Nevada Administrative Code (NAC 522.700, <https://www.leg.state.nv.us/NAC/NAC-522.html>); also see the Nevada HF fact paper, http://minerals.nv.gov/uploadedFiles/mineralsnv.gov/content/Programs/OG/HF_Facts_4-10-2017.pdf

In-field drilling of additional exploration wells typically occurs when initial drilling has located a geothermal reservoir, to define the limits of the geothermal reservoir. The process of in-field drilling is the same as that employed for initial exploratory drilling, although new roads and pads may not be required in every instance.

Production begins only if geothermal resources can be used at the surface in a power plant. In the BMD, because of limited infrastructure, geothermal resources are generally piped a short distance to an electric generation plant, then the electric would be connected to the power grid. If a nearby power grid is not available, electrical substations and connecting power lines would be needed. That is not likely to change because of the widely dispersed location of geothermal resources estimated to be present in the BMD. Electric generation facilities may include one or more of the following: a well head; pumping equipment; a separation system; pipelines; a metering system; turbine electric generation systems; water treatment and injection facilities; cathodic protection systems; electrical distribution lines; communication sites; roads.

Well Abandonment may be temporary or permanent. Wells are sometimes shut-in to control the geothermal reservoir and to serve as back-up supply or injection wells. If a well cannot be economically produced for geothermal fluid and it cannot serve as an observation or monitoring well, it will be permanently abandoned.

Reclamation includes removing all manmade objects and restoring the surface disturbance area to pre-disturbance conditions. In the case of a producing well, interim reclamation follows completion of drilling and well stimulation; final reclamation would be done after production has ceased. After re-vegetation is successful, reclamation is complete.

3.1.2 Direct and Indirect Effects

An EA must analyze and describe the direct effects and indirect effects of the proposed action and alternatives on the quality of the human environment. Direct effects “are caused by the action and occur at the same time and place,” while indirect effects “are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable” (40 CFR 1508.8). The sale of parcels and issuance of geothermal leases is strictly an administrative action. There would be no direct impacts from issuing leases because leasing does not directly authorize ground disturbing activities; no authorization for surface disturbance would be granted. However, if a lease is sold, the lessee retains certain rights. Once a parcel is leased, the lessee has the right to explore for and develop geothermal resources, subject to standard lease terms and special stipulations pertaining to the conduct of operations. Thus, a lease sale makes the offered parcels available to indirect effects (occurring at a later time). This chapter addresses those indirect effects. Additional site-specific, project-specific NEPA analysis would address direct and indirect effects of any future exploration, development or production.

3.1.3 Time Period Considered

The time period considered in this analysis is ten years, 2019 to 2029. This represents the initial term for a geothermal lease, which expires at that time if it has not been developed. If there is a proposal to develop a lease parcel, then additional project- and site-specific NEPA analysis would consider effects for a time frame appropriate to that project.

3.1.4 Analysis Area

The term Analysis Area refers to the parts of the Battle Mountain District in which the lease parcels occur, in central Nevada. It includes parts of Esmeralda County, northern Nye County, in the Tonopah Field Office area, and northeastern Lander County in the Mt. Lewis Field Office area (Figures 1-3).

3.1.5 Other Terms Used

The term “mitigation” as used in this document refers to resource protection measures that could be included in a specific proposal and implemented when leases are developed. The terms “effects,” “impacts,” and “consequences” are synonyms and may be used interchangeably. Definitions of other terms, abbreviations and acronyms used in this document are in Appendix F.

3.1.6 Supplemental Authorities and Other Resources Considered

To comply with NEPA, BLM is required to address certain elements of the environment that are subject to requirements, called “supplemental authorities,” which are specified in statute, regulation or by executive order (BLM 1988, BLM 1997, BLM 2008). Table 1 outlines these elements. Other resources considered are shown in Table 2. Resources not present or not affected are not addressed further.

Table 1 Supplemental authorities considered in the EA.

Supplemental Authority Element	Not Present	Present/Not Affected	Present/May be Affected	Rationale
Air quality, climate change and greenhouse gases			√	See Sections 3.2.1 and 4.2.1
Areas of Critical Environmental Concern	√			The proposed lease parcels are not located in or near any Area of Critical Environmental Concern.
Cultural resources		√		A Cultural Resources Inventory Needs Assessment was completed for this analysis. See Sections 3.2.11.
Environmental justice		√		A low-income population is present, and is not expected to be disproportionately affected. See Appendix J.
Farmlands, prime or unique	√			There are no Prime or Unique Farmlands, as defined by the Farmland Protection Policy Act, in the Battle Mountain District.
Noxious weeds and invasive, non-native species		√		Analysis at the leasing stage is based on the RFD scenario due to uncertainty regarding future development that would occur. Non-Native Invasive and Noxious Species is not an issue and therefore is not analyzed in detail. Any potential impacts from subsequent exploration and development activities would

Supplemental Authority Element	Not Present	Present/Not Affected	Present/May be Affected	Rationale
				be analyzed in a separate, site-specific analysis. See Sections 3.2.7 for a discussion of potential introduction of invasive species.
Native American cultural concerns		√		The BLM Battle Mountain District Office reached out to federally recognized tribes, in compliance with Executive Order 13175 Consultation and Coordination with Indian Tribal Governments, by sending letters May 3, 2019 inviting Tribes to consult. No issues with the Proposed Action have been brought forward at this time. The opportunity to consult is on-going. See Sections 3.2.12.
Floodplains			√	See Sections 3.2.4 and 4.2.4
Riparian/wetlands			√	See Sections 3.2.4 and 4.2.4; see 3.2.8 and 4.2.6 for riparian/wetland wildlife habitat
Threatened or endangered species			√	See Sections 3.2.8 and 4.2.6
Migratory birds			√	See Sections 3.2.8 and 4.2.6
Waste, Hazardous or Solid			√	See Sections 3.2.19 and 4.2.14
Water Quality, Surface and Ground			√	See Sections 3.2.4 and 4.2.4
Wild and Scenic Rivers	√			The proposed parcels are not located in or near any designated Wild and Scenic Rivers.
Wilderness and Wilderness Study Areas (WSAs)	√			None of the proposed parcels are within a designated Wilderness or WSA.
Lands with wilderness characteristics		√		See Section 3.2.15

Table 2 Other resources considered in the EA.

Other Resources	Not Present	Present/Not Affected	Present/May be Affected	Rationale
Fire management		√		Standard fire management stipulations would be included in any lease sale. Any potential impacts from subsequent exploration and development activities would be analyzed under a separate, project specific analysis.
Forestry and woodland products		√		See Sections 3.2.6 and 4.2.4
Geology and minerals			√	See Sections 3.2.16 and 4.2.12
Land use authorization			√	See Sections 3.2.17 and 4.2.12

Other Resources	Not Present	Present/Not Affected	Present/May be Affected	Rationale
Paleontological resources		√		See Sections 3.2.3 and 4.2.3
Rangeland resources			√	See Sections 3.2.10 and 4.2.8
Recreation		√		See Sections 3.2.13 and 4.2.11
Socioeconomic values			√	See Sections 3.2.18 and 4.2.13
Soils			√	See Sections 3.2.2 and 4.2.2
Specially designated areas	√			There are no areas of special designation overlapping the parcels.
Special status species			√	See Sections 3.2.8 and 4.2.6; list, Appendix D
Vegetation			√	See Sections 3.2.5 and 4.2.2
Visual resources			√	See Sections 3.2.14 and 4.2.11
Wild horses and burros		√		See Sections 3.2.9 and 4.2.7
Wildlife			√	See Sections 3.2.8 and 4.2.6

3.1.7 Environmental Consequences of the No Leasing Alternative (All Resources)

Under this alternative, no parcels would be offered for leasing in 2019. None of the activities associated with the RFD scenario in Appendix G would occur. As geothermal production is demand driven, additional production may take place in other states or regions of the world to produce the required fossil fuels.

3.2 Environmental Effects of the Proposed Action

3.2.1 Air Quality, Climate Change, and Greenhouse Gases

These interrelated resources are combined here for discussion and analysis. Air quality is affected by various natural and anthropogenic factors. Industrial sources such as power plants, mines, and geothermal extraction activities in Nevada contribute to local and regional air pollution.

Affected Environment

The U.S. Environmental Protection Agency (EPA) has established national ambient air quality standards (NAAQS) for criteria pollutants, including carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), particulate matter (PM₁₀ and PM_{2.5}), sulfur dioxide (SO₂), and lead (Pb). Exposure to air pollutant concentrations greater than the NAAQS has been shown to be detrimental to human health and the environment. The EPA has delegated regulation of air quality under the federal Clean Air Act to the State of Nevada. Other regulations control the release of hazardous air pollutants (HAPs): chemicals that are known or suspected to cause cancer or other serious health effects, such as reproductive effects, birth defects, or adverse environmental effects. EPA currently lists 188 compounds as HAPs, some of which can be emitted from geothermal development operations, such as benzene, toluene, and formaldehyde. NAAQS for HAPs do not exist; rather these are regulated by the source type, or specific industrial sector responsible for the emissions.

Ambient air quality is demonstrated by monitoring for ground level (i.e. receptor height) atmospheric air pollutant concentrations. In general, these measurements show that existing air quality in the region is good. Concentrations for all the criteria pollutants are below the applicable state and federal ambient air quality standards. Central Nevada has varying existing sources of pollution, mainly regional ozone and particulate matter. Regional ozone is typical in the western states as emissions from forest fires, transport from shipping lanes, electric power generation and other sources combine under certain meteorological conditions. Particulate matter is an issue during dust storms or when dust is raised by other activities in this dry region. For more information on pollutant monitoring values, including the other criteria pollutants not shown below, please visit the EPA's Air Data website at: www.epa.gov/airdata.

Climate is the composite of generally prevailing weather conditions of a particular region throughout the year, averaged over a standard period of 30 years. Climate change includes both historic and predicted climate shifts that are beyond normal weather variations.

Activities such as fossil fuel combustion, deforestation, and other changes in land use are resulting in the accumulation of greenhouse gases (GHGs), such as carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), water vapor, and several industrial gases, in our atmosphere. Greenhouse gas (GHG) emissions worldwide are estimated to be Global Warming Potential (GWP) 15,347,480,381 tons per year (tpy) mainly from CH₄ (International Panel on Climate Change Fourth Assessment Report).

Environmental Consequences of Proposed Action

The decision to offer the identified parcels for lease would not result in any direct emissions of air pollutants. However, any future exploration or development of these leases would result in emissions of criteria, HAP and GHG pollutants. These could result in an incremental increase in overall emissions of pollutants in the region, depending on any contemporaneous activities.

Air quality: Potential future development could lead to increases in area and regional emissions. As it is unknown if the parcels would be sold and developed, or the extent of development, it is not possible to reasonably quantify potential air quality effects via methods such as dispersion modeling. Specific locations, timing, construction and production equipment specifications and configurations are also unforeseeable at this time. Project specific air effects would be addressed in a subsequent analysis when exploration or development is proposed. All proposed activities would be subject to applicable local, State, Tribal and Federal air quality laws and regulations.

Future exploration or development activity could include soil disturbances from constructing well pads, access roads, pipelines, power lines, and drilling. Any disturbance is expected to cause increases in fugitive dust and particulate matter in the project area and immediate vicinity. Particulate matter, mainly dust, may become airborne when drill rigs and other vehicles travel on dirt roads. Air quality may also be affected by exhaust emissions from engines used for drilling, transportation, and other uses. These sources would contribute to potential short and long term increases in criteria pollutants: carbon monoxide, ozone (a secondary pollutant, formed photochemically by combining VOC and NO_x emissions), nitrogen dioxide, and sulfur dioxide. Non-criteria pollutants (for which no national standards have been set) such as carbon dioxide, methane, nitrous oxide, air toxics (e.g., benzene), and total

suspended particulates (TSP) could also be emitted. Certain pollutants may be of concern when evaluating air quality related values (AQRVs) for effects on visibility and atmospheric deposition, depending on proximity to sensitive receptors, area meteorology, and background levels of an AQRV at any sensitive receptor. Dust control measures, such as watering or applying gravel over travel surfaces and reducing speed along roadways, can effectively mitigate dust issues.

Climate: No GHG emissions would result from the Proposed Action, which is administrative in nature; however, the BLM recognizes that GHG emissions are a potential indirect effect of fluid mineral exploration and/or development subsequent to leasing. As a result, the analysis is limited to a qualitative description of pollutants associated with geothermal development and energy production and describes how the Proposed Action potentially contributes to climate change through the release of GHGs during construction. Although the EPA recently revised GHG emission factors used to estimate emissions from geothermal development and production, it would be a highly speculative exercise to quantify estimates of GHG emissions at the leasing stage. Any potential effects would occur if and/or when the leases were developed. While it is not possible to accurately quantify potential GHG emissions in the affected areas as a result of making the proposed parcels available for leasing, some general assumptions can be made: offering the proposed parcels for leasing may contribute to drilling new wells. Subsequent development of any leases issued would contribute a small incremental increase in overall GHG emissions during construction.

Climate Change Impacts: Secretarial Order 3289 was issued in 2009 which directs each bureau to: “consider and analyze potential climate change effects when undertaking long-range planning exercises, setting priorities for scientific research and investigations, and/or when making major decisions affecting DOI resources.”

The primary sources of greenhouse gases associated with geothermal exploration are carbon dioxide (CO₂), nitrous oxide (NO_x). In addition, volatile organic compounds (VOC) are indirect air pollutants that contribute to ozone production and aid in prolonging the life of methane in the atmosphere. With respect to climate change, climate plays a significant role in the production of ozone. Sunlight and high temperatures are a major catalyst in reactions between VOCs and NO_x in the production of ozone. With an increase in overall temperature, we can expect to have more hot days and less precipitation that will lead to a higher production of ozone.

GHGs are produced and emitted by various sources during phases of geothermal exploration and drilling production and injection wells. The American Petroleum Institute (API) categorizes sources of emissions from all geothermal operations into the following classifications:

Direct Emissions: Combustion sources includes stationary devices (boilers, heaters, internal combustion engines) and mobile devices (barges, railcars, and trucks for material transport; vehicles for personnel transport; forklifts, construction equipment, etc.).

Indirect Emissions: Direct and indirect GHG emissions may occur from various sources during each phase of exploration and well development. During exploration and well development, emissions are generated from well pad and access road construction, rigging up/down, drilling, well completion, and testing phases. GHG emissions for these phases are mainly CO₂ emissions

from internal combustion engines of diesel trucks, equipment, and rigs.

There are currently no established thresholds of significance for GHG, but the EPA has used a reporting threshold of direct GHG emissions of 25,000 tons per year of carbon dioxide equivalent (74 FR 56260, October 30, 2009). If geothermal fields are developed, power plants would produce an additional 30-40 MW of power without burning fossil fuels, such as coal. Producing power from geothermal, as opposed to coal, reduces CO₂ emissions by 48,210-64,280 kg.

While the RFD predicts that up to 60 to 80 exploration wells, 10-20 production and injection wells, and two geothermal power plants might be drilled as a result of the Proposed Action, BLM cannot predict the exact activities that will take place on any particular lease. Project-specific environmental analysis will be completed when a proposal is submitted to the BLM.

Development Greenhouse Gas Reductions: The amount of power generated by a geothermal field can be viewed as a savings of traditional carbon fired power generation. Binary geothermal plants produce near-zero emissions. Dry steam and flash geothermal energy plants emit 5% of the CO₂, 1% of the sulfur dioxide (SO₂), and less than 1% of the NO_x emitted by a coal-fired plant of equal size.

Mitigation: The BLM encourages industry to incorporate and implement BMPs to reduce impacts to air quality by reducing emissions, surface disturbances, and dust. In accordance with a recent BLM MOU regarding air quality analysis and mitigation, BLM would coordinate with the EPA and State agencies early in the GDP process to determine how best to model and mitigate for impacts to air quality. Measures may also be required as COAs on permits by either the BLM or the applicable state air quality regulatory agency. Such mitigation measures may include, but are not limited to:

- Water dirt roads during periods of (high) use in order to reduce fugitive dust emissions;
- Use of natural gas fired or electric drill rig engines;
- The use of selective catalytic reducers on diesel-fired drilling engines; and,
- Re-vegetate areas of the drilling pad(s) not required for production to reduce the amount of dust from the pad(s).

3.2.2 Soils

Affected Environment

Differences in climate, relief, aspect, slope, landform, elevation and parent material among other factors contribute to the formation of different soil types. High variability of these factors within the Analysis Area creates a wide variety of represented soil types. Soils range from those typically found in valley floors, deep and poorly drained due to high clay content with a highly alkali pH, to those common in the higher mountain elevations which tend to be shallow gravelly soils with near neutral pH.

Existing soils surveys are used to for evaluating land-use potential, potential plant communities and developing reclamation and rehabilitation plans. Three major soil orders dominate the Analysis Area: Aridisols, Entisols and Mollisols. A brief description of each soil order is provided in Appendix C.

Environmental Consequences of Proposed Action

There could be impacts to soils from future projects on any leased parcels, including such activities as geophysical studies, exploratory drilling, developing a well for production (with or without using HF), production infrastructures, road construction, pipelines, transmission lines, and gravel pit expansion. These actions would remove vegetation, potentially increasing wind and water erosion; cause soil compaction; and disturb microbiotic crusts and top soil. Removal of top soil would change soil texture and structure by mixing soil horizons and breaking up soil aggregates. The impacts of this surface disturbance would include changes in nutrient and water cycling, bulk density, water holding capacity, percent organic matter, and microbial activity. Also, removal and crushing of vegetation would occur through exploration and development activities. Considering the amount of disturbance anticipated in the RFD scenario, the impacts to soils are expected to be comparatively minor when compared to the areas offered for lease (approximately 7,590.50 acres), and temporary in nature because the majority of the disturbance (roads and pads) would be reclaimed.

Impacts to soil from these activities would be analyzed under additional site-specific environmental analysis when an action is proposed and specifics such as location, well depth, water consumption needs, and area of disturbance are known. Through this process, specific mitigation measures and BMPs would be attached as Conditions of Approval (COAs) for each proposed activity.

Concurrent reclamation would be completed for all producing well locations; this feature would provide improved soil stability onsite and control of any soil erosion that may take place. Native vegetation would be restored during concurrent reclamation, partially restoring the site's vegetative productivity. As for final reclamation, sufficient topsoil would be maintained, allowing the site to be restored to its original landform; and native seed would be used, restoring the site's full vegetative productivity.

A controlled surface use (CSU) stipulation for slopes greater than 30 and less than 40 percent requires engineering and reclamation that would avoid impacts, wherever these slopes exist on a parcel. A no surface occupancy (NSO) is applied to slopes exceeding 40 percent. Using GIS, the appropriate stipulation is applied to those proposed parcels that meet either definition (Appendix B). Also, sensitive riparian/wetland area soils generally have high susceptibility to disturbance and alteration; these would be protected by the Riparian Habitat and Riparian Habitat Buffer stipulations or the Riparian stipulation (Appendix B). The degree of protection would be adequate, because vulnerable soils would not be expected to extend beyond the area within which impacts would not be allowed (within 500 feet of wetland/riparian areas, floodplains or playas).

3.2.3 Paleontological Resources

Affected Environment

Paleontological resources are defined in the federal Paleontological Resources Preservation Act (PRPA [also commonly known as the Omnibus Act]) as the "fossilized remains, traces, or imprints of organisms, preserved in or on the earth's crust, that are of paleontological interest and that provide information about the history of life on earth" (16 United States Code [U.S.C.] 470aaa[1][c]). Formations or rock units which are known to yield vertebrate or significant invertebrate, plant, or trace fossils, have a high potential for containing significant paleontological resources. Most of the rock units within the nominated parcels have low to moderate potential for significant paleontological resources.

Environmental Consequences of Proposed Action

Paleontological resources may be subject to impacts from potential geothermal exploration and production activities; therefore, identification and evaluation of these resources would be required on a case-by-case basis prior to project implementation or ground disturbing activities. BLM Instruction Memorandum (IM) No. 2009-011 provides guidelines for assessing potential impacts to paleontological resources in order to determine mitigation steps for federal actions on public lands under FLPMA (Public Law [PL] 94–579, codified at 43 U.S.C. 1701–1782 and 18 U.S.C. 641) and NEPA. This IM also provides procedures for field survey and monitoring to avoid adversely affecting significant paleontological resources.

To help minimize any potential effects to paleontological resources, a standard Lease Notice, NV-B-00-A-LN, regarding fossils is included in Appendix B and attached to all parcels. This informs lessees of requirements to inform the BLM of fossil discoveries, and requirements for surveys, avoidance and/or data recovery prior to their disturbance. On-site monitoring may be necessary during construction activities.

Based on the above requirements, it is unlikely that indirect effects to paleontological resources from leasing the parcels would be substantial.

3.2.4 Water Resources

Affected Environment

Water is a fundamental component of ecosystem health, especially in arid regions where springs, seeps, wetlands and perennial streams are essential to biodiversity and play an important role in wildlife habitat and in the food chain for many wildlife taxa. The lease area is part of the Basin and Range Physiographic Province, a semiarid and arid desert environment with most precipitation originating as snow or occasional monsoon rainfall. Annual precipitation is highly variable: in Tonopah it is 4.8 inches and April, March and October are the wettest months, but at the Tonopah airport, a few miles away, precipitation is 5.1 inches and May and September are the wettest months (WRCC 2019b+c). Battle Mountain receives 8.1 inches of precipitation and April and May are the wettest months (WRCC 2019a).

Water in Nevada is owned by the people; however, the right to use surface and groundwater and management of water appropriations are administered by the Nevada Division of Water Resources (NDWR). Nevada's groundwater quality standards are based on the assumption that groundwater should be maintained suitable for use as a drinking water source, unless the natural water quality prevents this. The State adopts the Federal primary and secondary drinking water standards (maximum contaminant limits) for groundwater resources. The chemical character and quality of groundwater varies in the lease area and depends largely on the mineral content of the rock, residence time, evapotranspiration and temperature. Water Quality in Nevada is monitored by the Nevada Division of Environmental Protection (NDEP). The water quality standards of Nevada support other Federal laws such as the Clean Water Act of 1977, the Water Resources Planning Act of 1962, the Pollution Prevention Act of 1990 and the Safe Drinking Water Act of 1977 and are administered by the Nevada Division of Water Quality (NDWQ).

Groundwater: Precipitation and melted snow from mountainous areas runs off and either infiltrates into pediment deposits, or is lost to the atmosphere as direct evaporation or evapotranspiration. Water that

reaches the basins either seeps into deeper aquifers that compose the larger regional flow system or it intersects subsurface structures and upwells into surface water features, springs and pools. Perennial base flow from springs is largely driven by snowmelt runoff recharge. Soil type and geologic structure play an important role in where surface water will pool and how it will migrate, evaporate, or runoff. Playa soils are often prohibitive to vertical migration of surface water, such that surface waters pool up and eventually evaporate leaving evaporative salts. Depth to groundwater varies from a few feet to hundreds of feet depending on location.

Groundwater in central Nevada comes from water stored in alluvial aquifers, which are geologic units capable of storing and transmitting water at rates that are economically feasible. These units underlie and receive water from groundwater catchments, or hydrographic basins, which are the basic management units used by the Nevada Division of Water Resources (NDWR). Designated hydrographic basins (also referred to as hydrographic areas) are basins that the Nevada State Engineer (NSE) at NDWR declares as designated by order because permitted groundwater rights approach or exceed the average annual recharge, and where the water resources are being depleted or require additional administration. State-declared preferred uses may include municipal, domestic, industrial and agriculture. The NSE has additional authority to administer water resources in a designated hydrographic area.

The United States Geological Survey (USGS) has established a National Hydrography Dataset (NHD) for the entire United States. Based on standardized USGS topographic maps, this digital dataset further aids in determining water features at the surface. The proposed lease parcels are located in NHD hydrographic region 16, Great Basin. Lease parcels in the Battle Mountain District are located within the following sub-basins (Figures 6 and 12 in Appendix K).

Parcel 26 is located in Northern Big Smoky Valley, HUC sub-basin #16060004 and NDWR basin #137B, Big Smoky Valley. This basin drainage area is 1,323 square miles (mi^2) and the annual perennial yield is 65,000 acre-feet per year (AFY). Irrigation, mining, and quasi-municipal permitted water withdrawals exceed 58,000 AFY and NDWR has designated the basin O-852. The parcel location is near to Darrough's Hot spring.

Parcel 27 is located in Ralston-Stone Cabin Valleys HUC sub-basin # 16060011 and NDWR basin #143, Clayton Valley. Clayton Valley drainage area is 555 mi^2 , and the perennial yield is 20,000 AFY. Mining and milling water appropriations exceed 21,000 AFY thus NDWR has designated the basin, O-1275. The proposed geothermal lease parcel is near the mouth of Paymaster Canyon.

Parcel 52 is located in Fish Lake-Soda Spring Valleys HUC sub-basin #16060010 and NDWR basin #117, Fish Lake Valley. Fish Lake Valley drainage area is 706 mi^2 , and perennial yield is 30,000 AFY. Irrigation permits exceed 50,000 AFY and NDWR has designated this basin, O-704. The proposed lease parcel is northeast of the Fish Lake Valley playa. The parcel contains one geothermal temperature gradient well, 17-31 drilled in 2006. The parcel lands have no surface water features.

Parcels in Mount Lewis Field area fall within the HUC Basin: Humboldt. Parcels 132, 136, 140 and portions of parcels 133 and 137 are located in Middle Humboldt HUC Sub-basin #16040105, and NDWR basin #060, Whirlwind Valley. Whirlwind Valley drainage is 94 mi^2 and is coupled with Lower Reese River Valley (588 mi^2) to arrive at a combined perennial yield of 20,000 AFY. Permitted water use is

used for geothermal power generation, irrigation, and mining at 22,000 AFY, and Whirlwind Valley/Lower Reese River Valleys are both designated, O-799/739.

Parcels 133 and 137 are partially within Crescent Valley NDWR basin #054. Crescent Valley drains an area 752 mi² and the perennial yield is 16,000 AFY. Mining, irrigation, and municipal permitted uses are almost 17,000 AFY, thus Crescent Valley basin is designated, O-755. There are no surface water features or wells located on the proposed lease parcels in the MLFO.

Additional information may be found at the NDWR website (<http://water.nv.gov/>) using the basin names/numbers shown above.

Riparian/Wetland Zones: The health of riparian and wetland ecosystems is a function of water quality and supply. Riparian and wetland areas are the most productive and important ecosystems in the District. While they represent less than one percent of the area, they contain the majority of the biodiversity and perform vital ecologic functions. Research has shown that riparian and wetland habitat characteristically has a greater diversity of plant and animal species than adjoining areas.

Floodplains: The Federal Emergency Management Agency (FEMA) designates “Zone A” flood hazard areas. Zone A flood hazard areas are subject to inundation by the 1-percent-annual-chance flood event, and all perennial streams will have an associated floodplain. Any of the offered lease parcels with Zone A flood hazard areas will be subject to federal regulation and mitigation. Additional project-specific NEPA analysis to identify potential effects to floodplains and, if needed, alternative to avoid such effects, would be required prior to drilling in parcels that meet this designation, as per E.O. 11988 Section 2(a)(2) and FEMA guidelines (FEMA 2015).

Environmental Consequences of Proposed Action

The sale of parcels and issuance of geothermal leases is strictly an administrative action and site-specific, project-specific environmental analysis would address direct and indirect effects of any future exploration, development or production. Future exploration and development of a lease may result in long-and short term alterations to the hydrologic regime depending upon the location and intensity. Clearing, grading, and soil stockpiling could alter short-term overland flow and natural groundwater recharge patterns, but in most cases, these potential impacts can be mitigated by better location siting and engineering controls. The BLM may move a proposed well site up to 200 meters at its discretion to mitigate impacts, and the requirements of the Clean Water Act may necessitate relocating the well further. Parcel 26 is located near a flowing hot well and numerous springs and seeps (Figure 12, Appendix K). The standard lease notice for water resources is applied, as well as the Riparian and Riparian Buffer stipulations (Appendix B).

Groundwater: Potential future impacts of developing a lease may include degradation of water quality and drawdown of existing water levels through short term use during drilling. Water quality issues may arise from either underground or surface contamination. The primary cause of underground degradation would be from improperly functioning well casings, or surface activities, particularly from sumps and spills, that allow contaminants to infiltrate groundwater. Areas with shallow groundwater levels would be at greater risk. All future activities would be subject to State and Federal Regulations; site-specific COAs and BMPs would be an integral part of the approval of any GDP. Project specific surveys would be

performed as a preventative measure to establish baseline data needed to assess changes to groundwater levels and water quality.

Hydraulic fracturing (HF) is one method of well stimulation used in geothermal production. HF is designed to change the producing formations' physical properties by increasing the flow of water, gas, and/or oil around the wellbore. This change in physical properties may open up new fractures or enhance existing fractures that could result in freshwater aquifers being contaminated by natural gas, condensate and/or chemicals used in drilling, completion and HF. Historically, impacts to groundwater resources are due to improper well construction including insufficient or poorly installed surface and/or borehole seals (cementing), unsuitable construction materials and/or inadequate construction practices, introduction of surface contaminants into groundwater through surface spills, and/or loss of drilling, completion and hydraulic fluids into groundwater. Types of chemical additives used in completion activities may include acids, hydrocarbons, gelling or thickening agents, lubricants, and other additives that are specific for the well being treated.

All HF operations would be subject to the requirements of the State of Nevada, Adopted Regulation of the Commission on Mineral Resources R011-14, which hold the operator to a higher standard than the BLM's proposed HF rules. The Nevada HF rules require the use of multiple steel casing strings (Surface, Intermediate, and Production) with proper cementing (with required testing for efficacy) to isolate any usable groundwater or other resources from the well bore. The Nevada HF rules also require the disclosure of all chemicals used in an HF treatment, and continued monitoring of the well bore for any signs of leaking during the treatment. Proper casing and cementing along with monitoring would prevent contamination of groundwater from any HF or other well stimulation treatment. See Appendix E.

Standard BMPs and COAs include the use of lined pits with secondary containment and monitoring features for any flow-back or produced fluids which are designed to prevent any infiltration or other contamination of groundwater or surface water resources.

Surface Waters: Potential impacts may include changes to water quantity and quality. Runoff associated with storm events could increase sediment and salt loads in surface waters down-gradient of the disturbed areas. Sediment may be deposited and stored in minor drainages where it could move downstream during heavy storms and may be carried into contained basins and sloughs. This would be especially true in parcels 27, 52, 133, and 136 that occur on steep slopes, which would be more susceptible to erosion and consequent impacts to perennial streams, springs and seeps, and wetlands and riparian areas. The standard water resources lease notice, riparian habitat NSO, and riparian habitat buffer CSU stipulations for slopes would be applied to parcels with these concerns (Appendix B, and see Soils section) and require projects to be designed to avoid these impacts. All activities would be subject to State and Federal regulations, COAs and BMPS. If future surface disturbing activities are proposed near surface waters or wetlands and riparian zones, additional mitigation would be required.

Springs, Seeps, Riparian and Wetland Areas: Proposed lease parcel 26 is located in mapped fresh water emergent wetland. The flowing well at Darrough's Hot springs is the closest water source. The consequences of geothermal exploration or development in wetlands and riparian areas are potentially severe, as these environments are extremely sensitive to perturbation. The hydrogeology that results in spring discharge is often unique and complex. For springs, seeps, and spring-fed wetlands, there would be a slight risk that drilling would lead to changes in subsurface flow by modifying pathways of groundwater

flow. For any future proposed drilling, geophysical studies would be required which provide a subsurface view of the strata and their permeability, in which case the likelihood of penetrating a fault with groundwater flow would be minimized.

The predicted surface disturbance, although minor in area, would have a disproportionate effect in these environments. Road building could redirect water flows; any loss or diversion of water or instream flow can affect wetland and riparian health and impact these ecosystems. Contaminants from any accidental spillage are easily brought into solution and spread throughout the system. Human activity can affect turbidity and dissolved oxygen content, which in turn harm microbial life.

The Nevada standard lease notice is applied to all parcels, making buyers aware of the various Federal, State and local water laws that apply. The Riparian Habitat stipulation applies NSO to proposed parcels while the Riparian Habitat Buffer stipulations applies CSU to proposed parcels. CSU restrictions are measures designed to protect water resources and prevent erosion by using avoidance buffers, engineering controls, and mitigation for these resources wherever they may occur within a parcel. Proper application of the stipulation will protect water resources from unnecessary or undue degradation. It is applied to the ¼ ¼ sections that encompass the target resource to ensure even the smallest area of surface water resources would be protected while maximizing the area available for lease. No parcels are within 100-year flood plains or Playas. The proposed combination of avoidance buffers, engineering controls and mitigation requirements, along with the additional project and site-specific analysis and Conditions of Approval at the exploration and development stage, will meet the requirements of Executive Order 11988, Executive Order 11990, The Safe Drinking Water Act, and The Clean Water Act of 1972, and provide sufficient protection for water resources on the parcels.

3.2.5 Vegetation

Affected Environment

Vegetation in the Analysis Area provides forage and cover for wildlife, livestock, and wild horses. It also provides ground cover and root mass to stabilize soils and aids in infiltration of water into the ground. The type of vegetation in a particular area depends largely on soil types and average precipitation. The Natural Resource Conservation Service completed soil surveys and has developed ecological site descriptions from the information collected. Each ecological site description provides detailed information regarding vegetative communities and precipitation zones and is used for evaluating land-use potential, potential plant communities and developing reclamation and rehabilitation plans. Vegetative communities in the Analysis Area include Sodic Flats / Flood Plains, Salt Desert Shrub, Big Sagebrush, Black Sagebrush, Low Sagebrush, Pinyon-Juniper Woodlands, Riparian Wetlands, and Winterfat Bottoms; there are also areas dominated by annual plants. These vegetative communities are described in detail in Appendix C. Several SSS plant species occur in these communities (Appendix D).

Environmental Consequences of Proposed Action

There could be impacts to vegetation from future projects on any leased parcels. It is anticipated that the majority of the exploration is likely to occur in saltbush shrub or sagebrush type vegetation areas, rather than pinyon-juniper woodlands. Removal and crushing of vegetation would increase the amount of bare ground, thus increasing wind and water erosion; and increase the potential for invasion by nonnative and noxious species. Considering the amount of disturbance anticipated in the RFD scenario, the impacts to

vegetation are expected to be comparatively minor when compared to the areas offered for lease (approximately 7,590.5 acres), and temporary because most of the disturbance (roads and pads) would be reclaimed. Impacts would be considered under additional site-specific analysis when an action is proposed and specifics are known, like location, well depth, water consumption needs, and area of disturbance. Special status plant surveys would be conducted as needed at that time. Through this process, site-specific mitigation measures and BMPs would be attached as COAs for each proposed activity. Impacts to most vegetation communities are expected to be relatively minor, short term, and localized.

Geothermal development could potentially affect the quality and quantity of water in parcels where important wetland, springs, and playas occur. Riparian vegetation communities are fragile environments that could be impacted by disturbances to the timing and amount of water capture, water storage, and water release. If water resources were affected in these parcels, despite mitigation measures and BMPs, it could create changes in interspecies competition and potentially decrease biodiversity in riparian areas. There is a potential for more drought tolerant species and annual invasive species to outcompete native riparian species for limited nutrients and water. However, Riparian Habitat and Riparian Habitat Buffer stipulations provide protection for riparian-wetland vegetation because it requires avoidance, minimization or mitigation of impacts within 500 feet of wetland/riparian areas (see Water Resources section above). If parcels were developed in the future, (proponents would be required to implement) additional site-specific mitigation measures, BMPs, and COAs to reduce impacts, (and agency inspections would be conducted to ensure their accomplishment).

3.2.6 Forestry and Woodland Products

Affected Environment

The Analysis Area includes alluvial fans, foothills and valley bottoms which support mostly shrub and herbaceous species, and also consists of a large portion of barren or sparsely vegetated areas. Some of the parcels have pinyon and juniper woodlands, some of which have a very thick timber component, with canopy cover as great as 50% over the majority of the parcel. In addition there is the potential for riparian associated species such as cottonwood and willows, described in detail in Appendix C. Seeps, springs, and drainages can be found within parcel boundaries as described in the Water Resources Section, with the potential for impacts to riparian species.

Environmental Consequences of Proposed Action

There are minimal direct impacts associated with issuing a geothermal lease. However, it is reasonably foreseeable that geothermal exploration and development would occur over the next 10 years within the Analysis Area. The Riparian Habitat and Riparian Habitat Buffer stipulations would be applied to areas with potential for cottonwoods and willows, and is sufficient to protect these resources because it requires avoiding impacts to riparian vegetation (see Appendix B). Current forestry policy states that timber, cacti, or Joshua trees that will be damaged or destroyed as a result of clearing will be appraised and sold at the appraised value in accordance with 43 CFR 5420.0-6 and IB-2012-097. Also, if parcels were developed in the future, site-specific mitigation measures and BMPs would be attached as COAs for each proposed activity, which would be analyzed under project-specific NEPA analysis. Even if it is assumed that the maximum estimated potential future disturbance occurs within timbered landscapes, the effects would

still be negligible. This represents less than 0.05% of the more than 500,000 acres of pinyon and juniper woodlands within the Mt. Lewis Field Office area alone, where most of the timbered parcels are located.

3.2.7 Noxious Weeds and Invasive, Non-Native Species

Affected Environment

The BLM defines noxious weeds, invasive plants, and weeds with different, interrelated definitions (Appendix F). The BLM's policy relating to the management and coordination of these species is set forth in the BLM Manual 9015 – Integrated Weed Management. The BLM's primary focus is providing adequate capability to detect and treat smaller weed infestations before they have a chance to spread. Noxious weed control is based on a program of prevention, early detection, and rapid response.

Noxious weeds and invasive exotic plants are highly competitive and aggressive, and spread easily. They typically establish and infest disturbed sites, along roadsides and waterways. Invasive exotic and noxious plants are commonly found in Nevada in areas where there are seeps and springs or year-round water; regardless of whether a site is heavily disturbed, readily available water will increase the likelihood of all plant life including weeds. Wind, water, animals, vehicles/equipment, and humans spread invasive exotic and noxious weeds. Movement of plants from one site to another is greatly increased by introducing humans and equipment to an area. Changes in plant community composition from native species to non-native species can change fire regimes, negatively affect habitat quality, biodiversity, and ecosystem structure and function. There are known infestations of noxious and invasive exotic plants within the Analysis Area. Invasive non-native species also include animals; however, there are no records of invasive non-native animal species in or near the Analysis Area.

Environmental Consequences of Proposed Action

There would be minimal direct impacts from issuing new geothermal leases because leasing does not directly authorize geothermal exploration and development activities, and no ground disturbance would be authorized. The only impact that may occur would be an increase of movement of humans and vehicles to, from, and around the proposed parcels, which could slightly expand any disturbed areas within the sites and assist with the movement of noxious and invasive exotic seeds and other plant matter both within the sites and from the sites to other areas, or vice versa. Wind, water, recreation vehicles, livestock and wildlife would also assist with the distribution of weed seed into the newly disturbed areas.

Parcels with extensive seeps, springs, and wetland-riparian areas – where weeds are particularly likely to become established – would be protected by the Riparian Habitat and Riparian Habitat Buffer stipulation, effective immediately upon lease sale. The stipulation calls for avoiding impacts to the target resources, including an appropriate buffer (500 feet for water sources and riparian areas). Application of this stipulation would prevent disturbance to the soils and plant communities that could otherwise promote the spread of weeds in these areas, as described above.

If parcels were developed in the future, additional site-specific mitigation measures, BMPs, and COAs would be implemented to reduce impacts. These would include, but not be limited to, washing equipment at washing stations before bringing it to the project area, and after use; using certified weed-free seed to stabilize any topsoil stockpiles and for interim and final reclamation; and monitoring and treatment programs to detect and halt the spread of any invasive weed species.

3.2.8 Wildlife Resources

Affected Environment

Several wildlife species of particular management concern are likely to occupy the Analysis Area. Parcels with water resources (e.g., streams, springs, seeps and wet meadows) are likely to support a higher density of wildlife, including endemic aquatic and amphibious species. USFWS mapping identifies parcel 26 as within and parcels 132 and 137 as within 0.5 miles of freshwater emergent wetland. Such desert wetlands are rare and provide water and crucial habitat to many wildlife taxa, often including rare spring invertebrates and amphibians (discussed below) that have adapted to the conditions in their particular environment, isolated from similar species by the surrounding desert. Parcel 52 includes a small portion of a seasonally flooded playa; the Great Basin region hosts several rare invertebrate species that occur nowhere else but in this otherwise inhospitable environment. Playas often have the only water available in the desert; pronghorn and other animals may gather there to drink. Other important wildlife habitat types include big sagebrush (mountain and Wyoming big sagebrush), low sagebrush, pinyon-juniper woodlands, and salt desert scrub vegetation.

This section discusses select wildlife species or taxa (groups of species) that are known or likely to occur in the Analysis Area and for which federal law or BLM policy and guidance directs management actions, and includes preliminary scoping input from NDOW and USFWS for this EA. See Appendix D for an explanation and current list of Nevada BLM Sensitive species in the District.

Spring and spring invertebrates: While most cold and hot springs have not been surveyed for spring invertebrates, a number of springsnails have been identified to species level, and a number of Nevada springsnails have been, or are being considered, proposed for listing under the ESA. This is because many springsnails that have been identified to species level have subsequently been found to only exist within a specific spring (nowhere else).

- **Springsnails** (*Pyrgulopsis* spp.) are restricted to habitat in and near the sources of freshwater springs. A number of springsnails have been designated as BLM Sensitive species (Appendix B); more surveys are needed to document these species' occurrence, habitat, and population structure. Parcel 26 is located near spring sources and is within freshwater emergent wetland. BLM would consult with NDOW and USFWS on surveying the parcel for springsnails and other spring invertebrates if project specific activities are proposed. Stipulations, NV-B-10-A-NSO and NV-B-B-CSU are applied to parcel 26.

Fish and aquatic invertebrates generally occupy limited, isolated habitats in Nevada. BLM, Nevada Division of Wildlife (NDOW) and USFWS biologists identified the following species of conservation concern that are known to, or may, occupy habitat in or near proposed parcels. Some parcels may be located near these sensitive species' known ranges or known habitats. Thus, some parcels may contain as yet unidentified potential habitat.

- **Big Smoky Valley Speckled dace** (*Rhinichthys osculus lariversi*), a BLM and Nevada State sensitive species occurs roughly 1.5 miles southwest of proposed parcel 26, on private land.

Big Game: Bighorn sheep (*Ovis Canadensis*), a BLM Sensitive species, rely on proximity to rocky cliffs to escape predators; parcels 27 and 52 are partially within habitat for bighorn sheep, Figure 14. Pronghorn

antelope (*Antilocapra Americana*), are widely distributed across the Analysis Area. The habitat that antelope use year-round encompasses all of Parcel 26, and is contained partially within parcels 133, 137, and 140 (Figure 6); however no crucial winter habitat for pronghorn intersects with any proposed parcels. Depending on yearly habitat conditions, antelope fawning can occur anywhere within their distribution including playas where forage, water or cover is available. Mule deer (*Odocoileus hemionus*) will seasonally use a variety of vegetation types and habitats for forage, thermal cover and escape cover, while riparian areas, meadows and aspen stands are important for Mule deer as fawn-rearing areas. Mule deer crucial winter and winter ranges intersect several parcels (132, 133, 136, 137, and 140), in the Mount Lewis Field Office area (Figure 7). Mule deer and Bighorn sheep are listed along with the applicable TL stipulations or lease notices in Appendix B, using NDOW spatial data in BLM's corporate data layers as directed by NVSO.

Other mammal species of management concern include several BLM Sensitive species (Appendix D) which may be found in habitats that are widespread in the Analysis Area.

- **Pygmy rabbits** (*Brachylagus idahoensis*) typically require habitat that contains stands of tall, dense sagebrush that occur in areas with deep, loose soils for their burrows. Sagebrush is the pygmy rabbit's primary food and may comprise up to 99% of their winter diet; the shrub cover provides essential protection during dispersal.
- **Dark and pale kangaroo mouse** (*Microdipodops megacephalus* ssp., *Microdipodops pallidus*) are found in shadscale scrub, sagebrush scrub, and alkali sink plant communities. Dark kangaroo mice prefer loose sand and gravel, while pale kangaroo mice are mainly restricted to fine sands.
- **Bats**, many species of which are BLM Sensitive species, inhabit or use many habitat niches including caves, abandoned mines, cliffs, springs, riparian, aspen, pinyon-juniper, subalpine coniferous forest and desert shrub. Bats of the Great Basin frequently forage in riparian areas, while perennial stream corridors provide important bat habitat. Several proposed parcels are known to include bat roosts.

Greater Sage-Grouse, a BLM Sensitive species, occur in Eureka, Lander, northern Nye, and west White Pine Counties in both Districts, in foothills, plains and mountain slopes where sagebrush and meadows are in close proximity. Habitats used by sage-grouse often vary by season (breeding, nesting, early and late brood rearing, and wintering), but some habitats may be used year-round in some areas. The Analysis Area includes four parcels which are entirely within other habitat (OHMA) management areas, and one parcel is 50% in OHMA and 50% in general habitat (GHMA) as mapped under the 2019 GRSG Plan Amendment, as described under Regulatory Framework above; see Figure 9 and Appendix B for the intersection of proposed parcels with sage-grouse habitats. Available data indicate that nesting, brooding, summer, and winter habitat may occur not only in priority habitat (PHMA) and GHMA but also in many areas of OHMA. Applicable TL stipulations in Appendix B were applied using NDOW spatial lek data in BLM's corporate data layers and applicable maps from the 2019 Nevada and Northeastern California Greater Sage-Grouse Record of Decision and Approved Resource Management Plan Amendment. Three parcels fall within summer habitat as mapped by NDOW. One parcel occurs within 3.4 miles of an active lek and within 3.6 miles of a mapped lek, which are monitored by NDOW. TL stipulations are applied in Appendix B for parcels that intersect leks.

The 2019 ROD/ARMPA specifies that mineral resource developments must adhere to the new management directive (MD) for special status species (SSS) 5 (i-iv). MD SSS 5, in particular paragraph (ii) would likely directly apply to all five parcels, and if leased, would require compliance with state

regulation under State of Nevada EO 2018-32, which requires coordination with both the sagebrush ecosystem technical team (SETT) and NDOW, and the use of the mitigation hierarchy and the State's mitigation policies and programs.

Migratory Birds: A wide variety of bird species protected by the MBTA are found throughout all habitat types in the Analysis Area; see Appendix C for a discussion of major avian communities. Riparian vegetation associated with perennial streams, seeps and springs is particularly important for a diverse migratory bird community. Playas, if consistently flooded during the breeding season, may provide breeding habitat for BLM Sensitive western snowy plover (*Charadrius nivosus nivosus*); and even if only occasionally flooded, would then provide feeding and stopover habitat for migrating shorebirds and waterfowl. Potential western snowy plover habitat includes playas and associated springs and wetlands in Smoky Valley and Fish Lake Valley. See Appendix B lease notices apply to all parcels and lands and represent standard Best Management Practices for ensuring compliance with the Migratory Bird Treaty Act.

Raptors: Several raptor species are widespread in BMD. Golden eagles, prairie falcon, ferruginous hawk, red-tailed hawk, and burrowing owl are among the BLM Sensitive raptor species known to forage in the Analysis Area on a year-round or seasonal basis. All native North American birds of prey are strictly protected. Mountain ranges in or adjacent to the Analysis Area include important raptor habitats. No known raptor nests occur within the proposed lease sale parcels, however several (parcels 27, 133, and 137) have raptor nests within a half mile. In BMD, raptor occupancy surveys and presence of raptor nests are further scrutinized at the project specific level and are identified on lease stipulation NV-B-06-B-TL, see Appendix B.

Eagles: Bald & Golden eagles are further protected by the BGEPA. Both species occur in BMD. Parcel NV-19-09-137 abuts a known Golden Eagle nest location, and is within one half mile of additional eagle nest along the same steep ridge that is found just above this parcel. Parcel NV-19-09-133 is adjacent to a probable location of a Golden Eagle nest, as surveyed by NDOW, and the parcel boundary is 0.38 mile from a confirmed probable Eagle nest. All of these nests are monitored by NDOW. These are the closest nests, according to BLM's 2017 data, and all occur on the same side of the ridge as the proposed parcels. New nests may have been made in the area since the 2017 surveys. The eagle buffer distance that USFWS recommends is generally 1 mile from the nest, thus project specific activities that would occur on parcels within 1 mile from any eagle nest would require consultation with USFWS, particularly if activities were planned to occur during the eagle's 3 month nesting period.

Environmental Consequences of Proposed Action

Offering, selling, and issuing federal geothermal leases would not produce any direct impacts to wildlife resources. However, there may be indirect impacts from future ground disturbing activities on any leased parcels. At this time the specific acres and types of habitat that would be disrupted cannot be determined, as the BLM would not receive any applications for exploration or development until after the lease sale. At that time additional site-specific mitigation measures and BMPs would be included in the proposal or attached as COAs for each proposed activity, which would be analyzed under project-specific NEPA analysis including consultation with NDOW and USFWS as needed. BLM Nevada Standard Lease Notices, attached to all parcels (Appendix B), alert prospective lessees that the parcel "may now or hereafter contain plants, animals, or their habitats determined to be threatened, endangered, or other

special status species” and summarizes steps that may be required to address them. The Standard Stipulations also outline requirements to protect migratory birds under the MBTA.

To reduce potential impacts to wildlife from future exploration or development, stipulations are attached to specific parcels as listed in Appendix B, providing direction that must be followed in the specified habitat. If parcels were developed in the future, (proponents would be required to implement) additional site-specific mitigation measures, BMPs, and COAs to reduce impacts, (and agency inspections would be conducted to ensure their accomplishment)

Parcels that have crucial bighorn sheep or mule deer seasonal habitats as identified by NDOW’s spatial 2014 data would be addressed by timing limitation (TL) stipulations or lease notices, restricting use during the critical seasons to protect populations from disturbance (Appendix B; maps in Appendix K). When any proposal for exploration or development is approved, the proponent would be required to plan work so as to comply with TL stipulations. If, due to unanticipated delays, operations are ongoing when a restricted season begins, the authorized officer would confer with the proponent and a BLM or NDOW wildlife biologist familiar with the area and decide if and how operations may proceed.

Parcels with Greater Sage-grouse habitats have the appropriate Fluid Minerals stipulations applied as per the GRSG Plan Amendment (BLM 2019; see Appendix B of this EA). At the lease sale stage, BLM cannot apply stipulations beyond those specified by the 2019 GRSG Plan Amendment; but if parcels are leased, effects would be considered at the time of any future project proposal, potentially including additional mitigation measures, as needed.

The Riparian Habitat and Riparian Habitat Buffer stipulations applied to parcel 26, require additional environmental review, engineering controls, and mitigation measures within 500 feet of perennial waters, springs, wells, and wetland/riparian areas. Project specific surveys prior to any activities would establish baseline information and allow BLM to ensure avoidance and protection to species found. Inspection would also evaluate indirect impacts such as run-off, erosion, sedimentation, or accidental contamination that could extend into the protected area from a greater distance. Parcels at short distances to playas, that support seasonal feeding and stopover habitat for migrating shorebirds and waterfowl, such as the snowy plover, would also be surveyed to help protect this important habitat.

The standard lease notice for water resources applies to any aquatic habitat on the parcels, benefitting any aquatic invertebrates and amphibians of conservation concern whose presence cannot be confirmed due to incomplete survey data. Stipulations cannot be attached to a parcel to protect resources that are off-parcel; however, concerns about potential effects to aquatic and amphibious species off-parcel could be addressed by the additional project-specific analysis that would be conducted at the time of any exploration or development proposal, including consultation with NDOW and USFWS as needed.

In other habitats, generally mobile animals would avoid and move away from the project-associated noise and activities; some mortality could occur among small animals unable or less likely to move away; and there would be some loss of habitat. Based on the RFD scenario, geothermal exploration, production, infrastructure, and abandonment activities would continue to be minimal in the Analysis Area. If disturbances were to occur on all lease parcels under the current Proposed Action, the total disturbed area would represent 0.1% of that area. These activities are temporary in nature and most wildlife would likely eventually move back into the area after successful reclamation.

Artificial lighting from drilling rigs and other structures can have potential adverse impacts to wildlife such as insectivorous bats and insects. Guidelines for lighting intensity, orientation, etc. would be recommended at the time of any project proposal to avoid, minimize, and mitigate such impacts.

Based on the available resource protection measures in place, potential future exploration or development on leased parcels should not have any long-term or substantial impacts to wildlife resources.

3.2.9 Wild Horses and Burros

Affected Environment

Proposed lease sale parcels 27 and 52 are within wild horse Herd Management Areas (HMAs). Figure 19 in Appendix H displays the HMAs and parcels. These two parcels are within HMAs administered by the Tonopah Field Office.

Table 3. Acreage and population data for Herd Management Area with proposed lease parcels.

HMA	BLM HMA Acres	AML	Estimated Population ¹	Number of Proposed Lease Sale Parcels in HMAs	Proposed Lease Sale Parcel Acres in HMAs
Paymaster	101,392	38 horses	108 horses, 49 burros	1	639
Silver Peak	244,614	6 burros	61 horses, 4 mules	1	2,438
Total	346,006	44 animals	222 animals	2	3,077

Environmental Consequences of Proposed Action

The sale of parcels and issuance of geothermal leases is strictly an administrative action. The act of offering, selling, and issuing federal geothermal leases would not have direct impacts to wild horses and burros. On-the-ground impacts would not occur until a lessee applies for and receives approval to conduct exploration. The BLM cannot determine at the leasing stage whether a proposed parcel would actually be leased, or whether the lease would be explored or developed. Consequently, the BLM cannot determine exactly where on a lease a well may be drilled or what technology may be used, so the impacts listed below are derived from historical information and what might be proposed in the near future. Impacts of any future proposed exploration or development would be analyzed under additional project-specific environmental analysis to assess potential impacts to wild horses, burros, and their habitat.

Geothermal exploration and development is not common within HMAs. However, trends in exploration or development could change and could result in increased activity, which may or may not occur within HMAs or in areas that could affect wild horses or burros. Any potential effects would be addressed in project-specific analyses at the time of any proposal. Activities may include exploration, production and injection wells, infrastructures, road construction, and gravel pit expansion. These actions would remove vegetation, potentially increasing wind and water erosion; cause soil compaction; and remove and crush vegetation. See the Soils (3.2.2), Vegetation (3.2.5) and Water (3.2.4) sections of this EA for further discussion of potential impacts to these resources which constitute the habitat used by wild horses and burros.

The existing Shoshone Eureka and Tonopah RMPs do not include analysis of the impacts of geothermal leasing to wild horses and burros, or stipulations specific to those impacts. Refer to the Lease Notice – Wild Horse and Burro (#NV-B-05-A-LN) in Appendix B.

The primary indirect (potential future) impacts to wild horses and burros could include influence to herd distribution and movement patterns throughout the HMA and disturbance to the forage or water resources. Impacts could include displacement of horses/burros due to increased human activity. These impacts would likely be short term and would consist of animals moving out of the area or changing movement patterns to avoid possible noise disturbance and human presence. Increased traffic could increase risk of injury or death from vehicle collisions. The degree of disturbance would be proportional to the levels of exploration/development and increased activity in the area. These impacts would be analyzed in appropriate NEPA processes if exploration or development proposals are received for any leased parcels. At that time site-specific mitigation measures would be attached as COAs for each proposed activity and would identify BMPs to minimize or prevent vehicle related issues.

Wild horses and burros that commonly use a particular area that is developed for geothermal production would be pressured to move from that portion of the HMA, thus changing their movement and use patterns. Any activity that occurs near a water source such as a spring, stream or seep, or that causes a water source to be eliminated or contaminated, could have impacts to wild horse or burro distribution and use patterns and affect the overall water availability in the area. The magnitude of this change in movement would depend on the location, duration and extent of any future exploration or development. The standard lease notice for water resources (Appendix B) applies to any potential activity in the vicinity of water resources.

Two out of eight of the proposed parcels in the HMAs include land with slopes exceeding 30%. The stipulation applied to all parcels with slopes greater than 30% (Appendix B) would help to maintain site stability and reduce the risk of negative impacts to habitat used by wild horses and burros.

Exploration could result in localized and small scale vegetation disturbance or forage habitat fragmentation due to seismic testing, road construction, overland travel and drill pad construction.

Mitigation measures and best management practices (BMPs) would be developed in the course of site-specific or project-specific NEPA analysis. However, the following general measures would be taken if a parcel is developed:

- Avoid or minimize blocking access to water sources.
- Bury pipelines to avoid hindering animal movement patterns.
- Posted speed limits (and reasonable speeds where no limits are posted) should be followed by motorists to avoid colliding with wild horses and burros crossing roads.

Should a water source become unavailable due to exploration or development, the authorized officer may require alternate water sources be developed or made available to wild horses/burros, wildlife and livestock.

3.2.10 Grazing Management

Affected Environment

Livestock production is a major industry within the Battle Mountain District. The Range Program permits and manages public land grazing on 93 allotments for 95 permittees and approximately 377,810 Animal Unit Months (AUMs). An AUM is the amount of forage necessary for the sustenance of one cow or its equivalent for a period of one month. Most grazing allotments are comprised of both public and private lands; however, the majority of the allotments are dominated by public lands. Grazing permits are issued to qualified individuals or entities, and specify livestock numbers, season of use, kind of livestock and number of AUMs allowed for use. Other terms and conditions may be added to grazing permits for the orderly management of the permit and/or the livestock within the allotment(s). Each allotment may have one or multiple permittees. Range improvement projects on the allotments may include fences, cattle guards, pipelines, seedings, vegetation manipulation projects, troughs and wells.

Five grazing allotments include all or portions of the parcels proposed for leasing (Figure 10 and 17 in Appendix K). Table 4 shows the allotments within the Analysis Area, the public acres within the allotment, the number of acres of offered lease parcels within each allotment, the number of authorizations (permittees) within each allotment, the kind of livestock authorized, and active and suspended AUMs. Boundary grazing allotments may be managed by the adjacent District.

Table 4 Grazing allotments with proposed lease parcels for September 2019 lease sale.

Allotment Name	Allotment Public Acres	Approximate Lease Parcel Acres	Number of Authorizations	Kind	Permitted AUMs	Suspended AUMs
Argenta	141,335	4,239	9	Cattle Horse Sheep	18,025	0
Red Spring	149,150	614	2	Cattle	2,643	0
Silver Peak	281,489	1,821	1	Cattle	3,165	0
Sheep Mountain	88,435	12	1	Cattle	1,740	0
Smoky	125,247	239	2	Cattle	5,593	226

Environmental Consequences of Proposed Action

Potential future actions on leased parcels under the RFD scenario would decrease the public land acreage available for livestock grazing minimally, with potential to temporarily decrease the active AUMs in the affected allotment(s). Currently, available forage is allocated on public land at the allotment scale within the Districts. According to 43 CFR 4110.4-2 (a)(1), where there is a decrease in public land acreage available for livestock grazing within an allotment, grazing permits may be modified as appropriate to reflect the changed area of use. The established stocking rates (AUMs/Acre) will potentially be used to temporarily reduce the appropriate amount of AUMs within allotments based on the amount of acres impacted by future actions on leased parcels under the RFD scenario. However, these impacts are expected to be minor when compared to the total acreage of the grazing allotment(s) that may be affected; and would be temporary in nature, because the majority of the disturbance (roads and pads) would be reclaimed. Impacts to rangeland resources from these activities would be analyzed under an additional project-specific NEPA when an action is proposed and specifics are known, such as location, well depth, water consumption needs, and area of disturbance. Through this process, project-specific mitigation measures and BMPs would be attached as COAs for each proposed activity. Any potential impacts to existing range improvements would also be identified and mitigated via the project-specific analysis for any future exploration or development project on leased parcels.

3.2.11 Cultural Resources

Affected Environment

Cultural resources include prehistoric and historic-period resources such as buildings, sites, structures, objects, and districts. Prehistoric cultural resources are associated with the human occupation and use of Nevada before long-term European occupation. Such resources include but are not limited to Native American camp sites, rock art, and trails—some dating to over 12,000 years old. Historic-period cultural

resources include both the archaeological- and built-environment, such as buildings and structures, archaeological sites, and historic districts.

Parcels are located primarily in areas of little prior cultural resource survey. Although limited cultural resource surveys have been completed within the proposed parcels (less than 10% of the total parcel acreage has been surveyed at the Class III level) all are likely to contain areas of moderate and/or high sensitivity for cultural resources.

Environmental Consequences of Proposed Action

The act of selling geothermal leases in itself does not have the potential to impact cultural resources, as lease sales do not authorize exploration, development, or production that could directly or indirectly affect the environment; however, once issued, a lease bestows upon its owner the “right to use so much of the lease lands as is necessary to explore for, drill for, mine, extract, remove and dispose of the leased resource in the leasehold” (43 CFR§ 3101.1-2) subject to specific nondiscretionary statutes and lease stipulations (Appendix B).

Conservatively, based on the RFD scenario (Appendix G) surface disturbance associated with potential geothermal exploration and production activities could be expected to occur in the District. Cultural resources located within the proposed parcels would be subject to direct and indirect effects from geothermal exploration and development activities (e.g. ground disturbance and facilities construction). As such, identification and evaluation of these resources on a case-by-case basis for compliance with Section 106 of the National Historic Preservation Act (NHPA) would be required prior to project implementation or ground disturbing activities.

The Standard Lease Notice, NV-B-00-A-LN, would be attached to all leases within District to help minimize any potential effects on cultural resources located within the proposed parcels. This Lease Notice informs the lessee that their lease may 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. It also informs the lessee that the BLM will not approve any ground-disturbing activities that may affect any such properties or resources until it completes its obligations (e.g., State Historic Preservation Officer [SHPO] and tribal consultation) under applicable requirements of the NHPA and other authorities. The BLM may also 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.

3.2.12 Native American Cultural Concerns

Affected Environment

The Analysis Area lies within the traditional territory of the Western Shoshone Tribes. Sites and resources considered sacred or necessary to the continuation of tribal traditions include, but are not limited to: prehistoric and historic village sites, pine nut gathering locations, sites of ceremony and prayer, archaeological sites, burial locations, “rock art” sites, medicinal/edible plant gathering locations, areas associated with creation stories, or any other tribally designated Traditional Cultural Property.

Tribal ethnographic resources are associated with the cultural practices, beliefs, and traditional history of a community. In general, ethnographic resources include places in oral histories or traditional places, such as particular rock formations, the geothermal water sources, or a rock cairn; large areas, such as landscapes and views; sacred sites and places used for religious practices; social or traditional gathering areas, such as racing grounds; natural resources, such as plant materials or clay deposits used for arts, crafts, or ceremonies; and places and natural resources traditionally used for non-ceremonial uses, such as trails or camping locations. Future Native American consultations in the area may reveal such sites, activities, or resources.

The NEPA process does not require a separate analysis of impacts to religion, spirituality, or sacredness. References to such beliefs or practices convey only the terminology used by participants involved in current and historic ethnographic studies and tribal consultation and coordination, and does not reflect any BLM evaluation, conclusion, or determination that something is or is not religious, sacred, or spiritual.

Tribal Consultation and Information Sharing: The BLM Battle Mountain District has an ongoing invitation for consultation and information sharing with the tribes. Consultation and communication with these tribal/band governments have included letters, phone calls, e-mails, and visits with individual tribal/band Environmental Coordinators or other representatives. Consultation and information sharing will continue throughout the life of the project. The majority of lands in the Analysis Area have not been analyzed for ethnographic resources or Native American cultural concerns. The BLM contacted the Battle Mountain Band of Western Shoshone; the Duckwater Shoshone Tribe, and the Yomba Shoshone Tribe to identify areas of concern, mitigation measures, operating procedures or alternatives that may eliminate or reduce impacts to any existing tribal resources.

Environmental Consequences of Proposed Action

Although the act of issuing geothermal leases does not directly authorize exploration, development, or production, or any other related ground-disturbing activities, the potential exists for future such activities on leased parcels to impact Native American spiritual, cultural, or traditional sites. Such effects can be difficult to effectively mitigate; however, impacts can be minimized and/or mitigated when affected Tribes provide input and actively and fully participate in the decision making process. The standard lease notice (Appendix B) attached to all parcels states that BLM will not approve any ground-disturbing activities until it conducts its tribal consultation obligations, and may require modification to exploration or development proposals or disapprove any activity that is likely to result in adverse effects that cannot be successfully avoided, minimized, or mitigated. If projects are proposed on any leased parcel in the future, each would be analyzed under project-specific NEPA analysis. At that time the BLM would consult with the tribes and site-specific mitigation measures and BMPs would be attached as COAs.

3.2.13 Recreation

Affected Environment

The proposed lease parcels are all within dispersed recreation areas subject to public use. Dispersed recreation activities include off-highway vehicle (OHV) use, driving for pleasure, camping, mountain biking, sightseeing, rock collecting, photography, hunting, fishing, recreational shooting, trail running, hiking and bird watching.

Environmental Consequences of Proposed Action

Potential indirect (future) impacts could occur from activities on leased parcels. During the exploration phase, survey and drilling crews are likely to use available access roads and trails that are also used for dispersed recreation and access to recreation opportunities. Increased truck traffic during construction of access roads and well pads could affect recreation due to increased noise and dust levels and could cause temporary delays or closures on access roads. Construction sites are likely to limit public access, slightly decreasing access to the area for recreation and possibly displacing recreational users. Survey and exploration activities are likely to minimally impact recreation, if at all, due to the short duration, small crew size and temporary nature of the surveys and well drilling, along with the dispersed nature of recreation activities in these areas.

The production stage may include operation and maintenance of the constructed facilities. These activities require a small number of employees who would use access roads in the area but are not likely to limit recreational use of these roads. Geothermal production facilities are likely to have limited public access; this could slightly decrease access to the area for recreation and possibly displace recreational users. However, improved access to the general area for recreation may be available because of the maintained access road to the production facility. If parcels were developed in the future, mitigation measures and BMPs would be developed and attached as COAs for each proposed activity, through additional project- and site-specific NEPA analysis.

3.2.14 Visual Resources

Affected Environment

BLM Manual Series 8400 outlines the visual resource management (VRM) program. The BLM assigns VRM classes to public lands through the land use planning process, with management direction for each class. Attempts are made to mitigate visual contrasts from surface-disturbing activities regardless of the VRM class. VRM classes are based in part on a Visual Resources Inventory (VRI) which rates existing scenic values. The Tonopah RMP established VRM classes; the older Shoshone-Eureka RMP, Mount Lewis Field Office (MLFO) did not. Although VRI/VRM is shown on Figure 11 in Appendix K, no decision has been signed regarding visual resources at this time in MLFO. The Battle Mountain District will establish VRM classes for the Mount Lewis Field Office area as part the next RMP revision as priorities dictate. In the interim, visual resources will be managed with best management practices for multiple use.

All of the proposed lease parcels in the Tonopah Field Office area are in VRM Class IV (Figure 21 in Appendix K). Management direction for these classes, as stated in Tonopah RMP Determinations (p. 6), is as follows:

- Class IV Areas: Contrasts may attract attention and be a dominant feature of the landscape in terms of scale; however, the change should repeat the basic elements (form, line, color, texture) inherent in the characteristic landscape.

If and when a project is proposed, effects to visual resources, and measures to minimize them, would be considered as part of the additional project- and site-specific environmental analysis. Effects are assessed in terms of how conspicuous they would be from key observation points, such as roads or scenic overlooks. Structures in the foreground distance zone (0-½ mile) often create a contrast that exceeds the

VRM class, even when designed to harmonize and blend with the characteristic landscape. Approval by the Area Manager is required on a case-by-case basis to determine whether the structure(s) meet the acceptable VRM class standards and, if not, whether they add acceptable visual variety to the landscape.

Dark skies are also taken into consideration as a visual resource. Central Nevada, including the Analysis Area, generally offers outstanding night sky viewing opportunities with frequent clear weather and many areas of little or no light pollution.

Environmental Consequences of Proposed Action

Potential indirect (future) impacts that could occur on leased parcels may include, but are not limited to, contrast of line, shape, color, or texture due to roads, drill pads, drill rigs, tank batteries, temporary and long-term facilities and pump jacks; and impacts of nighttime lighting to dark skies. If parcels were developed in the future, site-specific visual resource mitigation measures and BMPs would be developed and attached as COAs for each proposed activity, which would be developed through additional project- and site-specific NEPA analysis. Potential methods to reduce impacts include, but are not limited to:

- designing lighting to reduce the impacts to night skies
- screening any stationary lights and light plants
- directing lighting onto the pertinent site only and away from adjacent areas not in use, with safety and proper lighting of the active work areas being the primary goal
- hooding and shielding lighting fixtures as appropriate
- using topographic features to visually screen facilities
- locating drill sites where they will be least conspicuous (BLM has the discretion to move proposed drill site locations up to 200 meters within the lease boundary)
- reducing the size or changing the configuration of drill pads
- using low profile tanks
- matching colors (approved by BLM VRM specialist) of facilities and equipment to blend in with the surroundings
- planning road alignment to minimize visual contrast
- required reclamation, which may include re-contouring drill pads; reclaiming roads; re-seeding drill sites and roads; and removing equipment and facilities

These methods, along with any others identified via NEPA analysis at the GDP stage, generally have the potential to minimize impacts to visual resources on public lands to the greatest extent practicable.

3.2.15 Wilderness Characteristics

Affected Environment

The Battle Mountain District has recently completed an inventory for lands with wilderness characteristics, defined by the Wilderness Act of 1964 as land that “(1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.” Section 201 of the Federal Land Management Policy Act

(FLPMA) requires the BLM to maintain, on a continuing basis, an inventory of all public lands and their resources and other values, which includes wilderness characteristics. It also provides that the preparation and maintenance of the inventory shall not, of itself, change or prevent change of the management or use of public lands. It does not address or affect policy related to Congressionally-designated Wilderness or existing Wilderness Study Areas. The Tonopah and Shoshone-Eureka RMPs do not address lands with wilderness characteristics. They will be addressed in future RMP amendments. In the interim, the District will manage lands with wilderness characteristics for multiple use.

In accordance with BLM Manual 6310, an inventory identifies any unit of land with at least 5,000 roadless acres or otherwise meeting criterion (3), then determines if that unit meets criteria (1) and (2). Lands meeting all three of these criteria are considered to have wilderness characteristics. There are four inventory units in the Analysis Area that were found to have wilderness characteristics. Of the eight proposed lease parcels, three proposed parcels intersect one or more of those four units, all are within Tonopah Field Office. A list of units with wilderness characteristics and parcels intersecting each is found in Appendix H; Figure 22, Appendix K).

Environmental Consequences

Future geothermal exploration and production projects on any leased parcels that intersect inventory units having wilderness characteristics could potentially affect those characteristics for the duration of the project, and such effects would be considered as part of a project-specific NEPA analysis. While BLM policy and the District's RMPs do not currently require managing lands so as to maintain wilderness characteristics, standard practices under several other policies would be applied that would tend to reduce these effects, as described below.

If new access roads were not restored to pre-disturbance conditions after a project, they could potentially reduce the size of a roadless area to less than 5,000 acres, in which case the inventory unit would no longer be considered to have wilderness characteristics unless it otherwise meets criterion (3). However, roads would generally be required to be reclaimed and revegetated to pre-disturbance conditions when the project is completed (see Section 3.1.1).

Geophysical exploration could temporarily affect opportunities for solitude, via the presence for a few hours or days of personnel and equipment, and in some cases noise and vibration that may be sensed at a distance. Exploration drilling could affect opportunities for solitude or for primitive and unconfined recreation for the duration of the project, via traffic, noise, dust levels, displacing recreationists and/or limiting access, as described in the Recreation section above. Potential effects discussed in the Visual Resources section above – due to such factors as roads, drill pads, drill rigs, tank batteries, temporary facilities, and impacts of nighttime lighting to dark skies – would affect the appearance of naturalness, and would be minimized to some extent by policies also discussed in that section. Exploration projects that do not proceed to development and production end with reclamation (Section 3.1.1), which would return the area to a natural-appearing condition, and impacts to solitude and recreation would also cease.

Development and production could produce effects similar to those of exploration drilling but that would be more long-term and could potentially cause an inventory unit to no longer be considered to have wilderness characteristics under criteria (2) and (3) in a subsequent inventory, depending on such factors as the number and placement of wells and long-term facilities in relation to the unit's size, configuration,

and topographic and vegetative screening; and the success of measures taken to minimize effects. An inventory unit can have wilderness characteristics even though every acre within the unit may not meet all the criteria. If wells and facilities are “substantially unnoticeable” in the context of the unit as a whole, and the unit overall still “generally appears” natural, the unit could still meet criterion (1). If “outstanding opportunities” to experience solitude *or* primitive and unconfined recreation (not necessarily both) still exist within the unit as a whole, it could still meet criterion (3). BLM Manual 6310 provides further information on how these criteria are applied in the wilderness characteristics inventory process.

When production has ceased, final reclamation would be completed (Section 3.1.1) and all impacts to wilderness characteristics would cease.

3.2.16 Geology and Mineral Resources

Affected Environment

This section discusses extractive mineral uses that may exist in the Analysis Area and be potentially affected by the Proposed Action, with a brief overview of regional geology as background. The Basin and Range province is comprised of north-south trending mountain ranges separated by broad valleys, created through extension of the earth’s crust where portions of the crust were faulted and either down dropped, creating basins or uplifted, creating mountains. The resulting separation and crustal thinning brought magma heat sources close to the surface, leading to volcanic activity, superheated fluid, associated intrusive and igneous activity, and maturation of hydrocarbon sources. This geologic setting has been instrumental in the location of and potential for numerous economic metallic mineral deposits in the Analysis Area, as well as development of economic geothermal resources.

Nevada is seismically active, with numerous earthquakes each year; most are small and the epicenters can be several miles below the ground surface.

Locatable Minerals historically or currently mined within the Analysis Area include metallic minerals: gold, silver copper, mercury, zinc, molybdenum, manganese, uranium, and tungsten, and industrial minerals: limestone, barite, gypsum, diatomaceous earth, sulfur, and fluorspar. Geothermal interests may potentially overlap with those of mineral exploration; and mining claims, mining notices, or plans of operation may overlap the parcels, so that coordination with the claimant may be necessary.

Mineral Material Sale of common minerals encompasses petrified wood and common varieties of sand, stone, gravel, pumice, pumicite, cinder, and clay. Less common are sales of topsoil and specialty sand, gravel, or decorative rock. Saleable mineral sites with a priority for use are located along State, County, and BLM managed roads. These types of saleable minerals are distributed throughout Nevada and overlap with geothermal lease parcels should be expected.

Leasable Minerals are those that may be extracted from leases on public lands and are subdivided into solid and fluid leasable mineral groups. Solid minerals include coal, sodium, sulfur, potassium, and phosphate (and under certain conditions, sand, gravel and locatable minerals). Fluid minerals include oil, gas, and geothermal resources.

Oil and Gas Lease parcels on public lands have been available within the District for several decades. The main producing oil fields are located within Railroad Valley and Pine Valley; however, exploration

for oil and gas could be expected in Diamond Valley, Garden Valley, Big Smoky Valley, Ione Valley, Fish Creek Valley, Antelope Valley, and Big Sand Springs Valley. Natural gas is not produced in commercial quantities in Nevada.

Geothermal Lease parcels on public land have been available within the District for several decades. Geothermal leasing and development may occur anywhere on public land with the exception of specific closures such as Wilderness Areas, Wilderness Study Areas, community watersheds, critical wildlife habitat areas, and military reservations. Approximately 20 percent of the land within the District is potentially valuable for geothermal resources, located mainly in Esmeralda and Lander counties. The 2008 *Geothermal Programmatic Environmental Impact Statement for Geothermal Leasing in the Western U.S.* expedites processing geothermal lease applications.

Environmental Consequences of Proposed Action

If any parcels are leased and developed, design features, project- and site-specific mitigation measures and BMPs would be attached as COAs for each proposed activity, which would be developed through additional site-specific NEPA analysis. The included stipulations (Appendix B) offer an advantage to prospective lessees in that they identify important natural resource issues associated with particular parcels – water resources, steep slopes, and deer and pronghorn seasonal habitats – in advance, along with measures to protect them. This would reduce some of the uncertainty of waiting for site- and project-specific NEPA analysis to identify resources of concern and define appropriate COAs.

The potential that geothermal interests may overlap with other solid or fluid mineral exploration exists. Due to the uncertainty and expense of finding a geothermal resource, geothermal exploration wells may be left unplugged for an extended period of time. Thermal gradient wells may be monitored many decades past the date of drilling in efforts to further delineate a geothermal resource and/or to be used to monitor a geothermal reservoir at a later date when a production well is drilled. The majority of pad disturbance is usually reclaimed within 5 years. Geothermal exploration is a long-term endeavor (5-20 years), but does not hinder further mineral exploration or development. Agreements between geothermal and mineral operators could help to mitigate those acres that would be used for geothermal production on a more long-term basis. Any potential impacts to existing mineral estate would be identified and mitigated via the project-specific analysis for any future exploration or development project on leased parcels.

Geothermal exploration and development activities could require additional gravel pit expansion, but the small requirements for each project would not greatly increase the size or number of gravel pits, nor would it burden the communities that use gravel.

3.2.17 Land Use Authorizations

Affected Environment

All of the proposed lease parcels are on public lands with federally controlled surface and subsurface mineral estate. Many would require a right-of-way (ROW) to access them. Some proposed parcels include pre-existing land use authorizations such as grants, leases, permits and withdrawals; and new ones may be authorized prior to any proposals for exploration by a geothermal lessee. In these instances, the holder of land use authorization would have a valid existing right to the authorized use of public lands within the

lease. Appendix I and Lease notice NV-B-13-A-LN provides a summary of the existing land use authorizations in the proposed lease parcels.

Environmental Consequences of Proposed Action

Future activity on leased parcels could impact existing ROWs. FLPMA requires that prior existing rights must be recognized. Any conflicts would be mitigated through agreements between relevant operators. If parcels were developed in the future, site-specific mitigation measures and BMPs would be attached as Stipulations for each proposed activity. Applications for new ROWs may be required for roads for geothermal exploration and production activities. These off-lease ROWs would be non-exclusive where possible, that is, could be used by the general public for other purposes such as access to public lands.

3.2.18 Socioeconomic Values

Affected Environment

The proposed lease parcels are located within three rural counties in central Nevada: Esmeralda County (2 parcels), Lander County (5 parcels), and Nye County (1 parcel). As of the 2017 U.S. census these three counties together had a mean average population density of 1.8 persons per square mile (Table 5).

Table 5 Population density by county.

County	Area, mile²	Population, 2017 census	Population density per mile²
Esmeralda	3,589	1,102	0.31
Nye	18,199	43,296	2.38
Lander	5,519	5,887	1.07
3 Counties	$\Sigma=27,307$	$\Sigma=50,285$	$\bar{x} = 1.84$
(Nevada)	(110,572)	(2,839,172)	(25.7)

Primary activities that contribute to the economic base of central Nevada are minerals extraction and energy production, including renewable energy; agriculture (especially cattle and sheep ranching and alfalfa hay farming); and recreation. Small towns and unincorporated communities nearest the Analysis Area and most likely to experience economic effects of any future exploration, development or production on leased parcels include Tonopah, Silver Peak, Dyer, Battle Mountain, Round Mountain, Carvers, and Hadley.

Executive Order 12898 required federal agencies to promote environmental justice by determining, and addressing as needed, whether the agency's programs, policies, and activities have a disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. When considered at a scale of county sub-regions surrounding the Analysis Area, while there are no known communities with disproportionate representation of any minority race or ethnicity as compared to the state of Nevada overall, the region does have a large low-income population as compared to the state overall; however, it would not be disproportionately affected. See Appendix J.

Environmental Consequences of Proposed Action

Leasing, exploration, and development of geothermal resources generate revenue to Federal, state, and local governments. Fifty percent of all bonus bids, rents, and royalties collected by the federal government is provided to the state government and an additional 25 percent to county governments (FY 2018 geothermal revenues in Nevada were over \$5.1 million, 75% of which was disbursed to the State

and counties). Increased taxes are paid to government in a variety of forms including income and property taxes by both the geothermal production operators and their employees.

During development and production phases, the potential for local socioeconomic impacts could increase. Governments would also be able to provide additional public services such as possible building of new roads and road maintenance. Typically, most of this work is supplied by local contractors. Local businesses may realize increased revenue from the purchase of supplies, meals, rooms, etc. Local trucking and delivery companies may also benefit economically by transporting supplies, building materials and oil products. The additional economic activity and employment results in a trickle-down effect, supporting employment and economic activity in other sectors of the economy including housing, retail, services, and government.

These positive indirect impacts to socioeconomics would likely be minor, given the RFD scenario (Appendix G); however, bonus bids (the amount paid at time of auction), annual rent fees (for 10 years regardless of activity on a leased parcel), and royalties (if and when production occurs) may provide substantial income to county governments for schools and other expenditures. The potential for adverse effects to the human environment, including human health hazards, is considered to be low (see effects analyses for air quality, section 3.2.1; water, 3.2.4; hazardous and solid waste, 3.2.18). The Proposed Action would not induce substantial growth or concentration of population, displace a large number of people, cause a substantial reduction in employment, reduce wage and salary earnings, cause a substantial net increase in county expenditures, or create a substantial demand for public services.

Leasing activities may also generate economically valuable information. Exploration generates information about the geology and mineral resources at a particular location. That information can usually be used to infer or predict the structure and location of geology and mineral resources in a much wider area. The more information available, the greater the possible discovery of future mineral deposits or fluid mineral resources, including geothermal. For any future proposed project on any parcel that is leased, additional site-specific, project-specific analysis would be required, including a thorough examination of socioeconomics and environmental justice. The required NEPA analysis would address all aspects of exploration, development and production, including connected actions such as transportation of any oil or gas produced.

3.2.19 Waste, Hazardous and Solid

Affected Environment

The majority of the proposed lease parcels are in rural areas and not adjacent to any schools or populated centers. However, there are several ranches and ranching/mining communities within close proximity.

Environmental Consequences of the Proposed Action

Geothermal activities including exploration drilling, extraction, production facilities, pipeline transport, and tanker loading, unloading and transport, have the potential to affect the environment through production of waste fluids, emissions and site impacts resulting from field development and related infrastructure. Oil spills, produced waters, drill fluids/cuttings, and hazardous materials could be encountered at a facility or drill pad. Under any alternative, all appropriate statutes, regulations and policies (see Section 1.4) and Gold Book standards, guidelines and BMPs would be applied.

The RFD scenario (Appendix G) predicts that approximately 60-80 exploration or temperature gradient wells could be drilled in the next twenty years. If a resource is found, 10-20 production and injections wells would then be drilled to support two geothermal power generation facilities. Examples of indirect (future) environmental impacts from hazardous materials, hazardous waste, and solid waste which might be encountered during each phase are provided below. However, most of these incidental impacts, if not all, can be avoided or lessened through proper inspection and maintenance.

Exploration: Impacts could include drilling fluid or hydrocarbon spills, leakage from improperly constructed reserve pits or wastewater collection systems, improperly handled brine backflow water from drilling that may or may not have used HF technology, and accumulations of solid waste, which could impact water quality or contaminate soils. Hydrocarbon spills could consist of hydraulic fluid, gasoline, diesel, oil, or grease from vehicles, generators, and exploration drill rigs. Backflow water from exploration drilling can be extremely saline; improper disposal could raise the pH of existing surface waters to unacceptable levels. Accumulations of nonhazardous solid waste could include trash, drill cuttings or mud, wastewater, bentonite and cement generated during drilling operations.

Development: Impacts could be the same as in the exploration phase; however, the quantities of hazardous materials, hazardous waste, or solid waste used and generated could be greater. Accidental releases from reserve pits or waste water collection systems could include hazardous water treatment chemicals such as chlorine. When fracked water comes back to the surface as backflow, it can contain high levels of salts, introduced chemical additives, and various chemicals and compounds that occur naturally within the earth. Backflow spills have been known to kill off all vegetation and render the soil unusable. Nonhazardous solid waste such as drill cuttings or mud could be generated at this stage.

Production: Most power generation facilities have very little opportunity for fluid spills. Hydrocarbons are used to lubricate pumping equipment, gears, and moving parts. These discharges could result in impacts to soil, air, water, and wildlife. Storm water runoff containing hydrocarbons could be problematic. Nonhazardous solid waste could also be generated.

Final Abandonment: The operator would identify, remove, and properly dispose all hazardous materials, hazardous waste, and solid waste. Spills could occur during removal.

When the RFD scenario are considered, impacts would generally be negligible because the substances involved would be properly handled, stored, and disposed of in accordance with applicable federal, state and local regulations. Proper management of these substances would ensure that no soil, ground water, or surface water contamination would occur with any adverse effect on wildlife, worker health and safety, or surrounding communities. Additional project- and site-specific environmental analysis of any future exploration, development and/or production would allow inclusion of updated mitigation measures, BMPs, and COAs; and performance standards would be defined at that time.

Impacts of any hazardous waste spills in areas with water resources would be potentially substantial and difficult to mitigate. The Riparian Habitat and Riparian Habitat buffer stipulations as well as the standard lease notices would require avoiding impacts within 500 feet of surface waters and riparian areas; and impacts to floodplains and playas. Application of this stipulation would not only prevent surface disturbance within the defined areas but would also prevent indirect impacts including accidental contamination.

Chapter 4 Cumulative Effects

The Interdisciplinary Team analyzed cumulative effects to the Analysis Area and the surroundings. Cumulative impacts are those effects on resources within an area or region caused by a combination of past, present and reasonable foreseeable future actions (RFFAs). These impacts may be individually minor but added together over time may become significant (40 CFR 1508.7).

4.1. Methods and Assumptions

To be cumulative, effects must overlap in both time and place. As with the effects analysis in Chapter 3, it is unknown if, when, or where exploration or development projects would be proposed; nor is it known what types or extent of projects would be proposed; therefore this analysis considers general possible effects of future uses of the lease parcels. A more specific cumulative effects analysis would be part of the NEPA process for any project proposed.

4.1.1 Alternatives Considered

The ID Team considered cumulative effects of the Proposed Action and No Leasing Alternative (Section 2.1) on all resources. For all resources, the difference between these and the No Leasing Alternative is simply that cumulative effects would occur on other leased parcels. The No Leasing Alternative is not discussed separately in Section 4.2.

4.1.2 Cumulative effects study area, timeframe, and RFD

The cumulative effects study area (CESA) for this EA encompasses the entire BLM Battle Mountain District in central Nevada (see Figure 1). The analysis uses the same 10-year timeframe and reasonably foreseeable development (RFD) scenario as described in detail in Appendix G.

4.1.3 Reasonably Foreseeable Future Actions (RFFAs)

Along with geothermal exploration, development, power facilities and infrastructure, and eventual abandonment as described under the RFD scenario, based on recent and current activities the following future actions could occur concurrently in the District during the next 10 years:

- geothermal exploration and development
- mineral exploration and mining
- gravel pit development and production
- wind power construction
- communication site construction
- road building
- powerline construction
- livestock grazing
- fence construction
- off-highway vehicle use
- non-motorized recreation such as hunting, mountain biking, geo-caching
- withdrawal of water for irrigation (agriculture) and mining
- wild horse/burro gathers
- noxious weed treatment
- fire suppression and rehabilitation
- construction of wildlife habitat improvement project

4.2 Cumulative Effects Analysis

4.2.1 Cumulative Effects to Air Quality, Climate Change, Greenhouse Gases

Cumulative effects to air quality would occur as a result of a geothermal drilling permit and development and not from the Proposed Action of offering lease parcels. Environmental effects to air quality and climate change within the CESA from past, present, and reasonably foreseeable future actions include fugitive dust emissions, including particulate (PM_{2.5} and PM₁₀), combustion emissions from vehicle-based activities such as agriculture, road construction and maintenance, off-highway vehicle (OHV) use, exploration and mining activities, aggregate operations, public land management activities, and wildland fire, and greenhouse gas emissions from grazing. Industrial and mining activities within the CESAs greater than five acres (20 acres for minerals projects) of surface disturbance are required to obtain and operate under an air quality permit from the State of Nevada Bureau of Air Pollution Control (BAPC). Effects to air resources from past and present actions in the CESAs are considered to be moderate lasting only as long as the activities persist.

The incremental increase in these impacts is small when compared to the level of impacts that already exist in the region as described above in section 3.2.1. Given that geothermal production worldwide is largely demand driven, these cumulative impacts would be expected to continue to occur under either of the alternatives; however, exploration and development of geothermal resources are offset by geothermal energy production over conventional methods of energy production.

4.2.2 Cumulative Effects to Soils and Vegetation

The disturbance associated with geothermal exploration and production would add to the disturbances from mining exploration, mine development, grazing management, wild fires, fire rehabilitation and range improvement projects. Creating new roads, constructing drill pads and developing wells and mines removes available vegetation and increases the susceptibility of soil to wind and water erosion, soil compaction and invasion by invasive species, and disturbs microbiotic crusts and top soil. However, the cumulative impacts of geothermal exploration and development on soils are generally expected to be minimal due to the relatively small area of disturbance in the RFD timeframe, concurrent reclamation, and the development of site-specific mitigation and BMPs. Wetlands and riparian soils and vegetation would be protected by the standard lease notice for water resources, and riparian habitat, riparian habitat buffer, and steep slopes stipulations (Appendix B).

4.2.3 Cumulative Effects to Paleontological Resources

Several ongoing and potential actions in the area, such as mining, mineral and geothermal exploration, off-highway vehicle use, and livestock grazing, have the potential to cumulatively impact paleontological resources. The geographic scope or extent of cumulative impacts for paleontological resources is generally the geographic formation in question. None of the proposed parcels have been surveyed to determine the boundaries and geographic extent of fossil resources or any paleontological localities. Parcels identified as having low potential for containing significant paleontological resources would not be subject to cumulative effects; however, BMPs and COAs would apply in the event a significant paleontological resource were encountered as a result of any ground-disturbing geothermal exploration or development activities. Parcels identified as having moderate to high potential for containing significant paleontological resources may require a field determination to map locations of any vertebrate fossils or

any scientifically significant fossils; once mapped, the geographic and temporal scope for paleontological resources can be defined, followed by an analysis to determine what, if any, impacts there would be to paleontological resources resulting from past, present, or reasonably foreseeable actions in the CESA. It is expected that the proposed action may contribute to cumulative impacts through the reasonably foreseeable role of geothermal exploration and development; however, with implementation of appropriate mitigation, BMPs, and the COAs, impacts may be avoided.

4.2.4 Cumulative Effects to Water Resources, Forestry and Woodland Products

The Riparian Habitat NSO and Riparian Habitat Buffer CSU stipulations would provide adequate protection (Section 3.2.4), so the Proposed Action would not contribute to a risk of cumulative impacts to these resources. As any exploration and development efforts on leased parcels would be focused outside and away from riparian vegetation, there would be little potential for the Proposed Action to contribute to cumulative effects to cottonwood and willow. For woodland products, even if it is assumed that all acres of estimated potential future disturbance occur within timbered landscapes, the contribution to cumulative effects would still be negligible as this represents less than 0.1% of the more than 500,000 acres of pinyon and juniper woodlands within the Mt. Lewis Field Office alone.

4.2.5 Cumulative Effects to Noxious Weeds and Invasive Species

Potential exploration and development resulting from leasing the parcels would increase surface-disturbing activities that remove vegetation, compact soil, increase erosion and sediment yield, may result in fragmented native plant communities and increase competition from noxious weeds, invasive and non-native species. The disturbance associated with potential geothermal exploration and production would add to the disturbances from mining exploration, mine development, grazing management, wild fires, fire rehabilitation and range improvement projects; disturbed areas would be more susceptible to invasion by invasive species, as described in Section 3.2.5. However, the cumulative impacts of geothermal exploration and development are expected to be minimal in most areas due to the relatively small area of disturbance in the RFD timeframe, concurrent reclamation, and the development of site-specific mitigation and BMPs, likewise noxious weed treatments are very small in size in comparison to parcel acreages. The BLM Standard Lease Notices, Riparian Habitat, and Riparian Habitat Buffer stipulations applied to the Proposed Action is expected to reduce cumulative effects to noxious weeds and invasive species in riparian and wetlands vegetation communities.

4.2.6 Cumulative Effects to Wildlife Resources

Cumulative impacts from geothermal exploration and production activities would add to the impacts of other past and present actions and RFFDs that impact habitat or displace wildlife. In upland habitats, the cumulative impact to wildlife and associated wildlife resources from geothermal exploration and production activities would generally be expected to be short-term and minimal due to the relatively small area of disturbance in the RFD scenario timeframe, concurrent reclamation, and the development of site-specific mitigation and BMPs. Greater sage-grouse seasonal habitats are addressed by stipulations (Appendix B). The Proposed Action would not contribute substantially to cumulative effects to aquatic, wetland and riparian habitats, due to the Riparian Habitat NSO and Riparian Habitat Buffer CSU stipulation. Mule deer, pronghorn and bighorn sheep are protected by TL stipulations applied to their crucial seasonal habitats, and the TL lease notice applied to mule deer movement corridors.

4.2.7 Cumulative Effects to Wild Horses and Burros

Past, present and reasonably foreseeable projects that have had and could continue to have impacts to wild horses and burros in the assessment area include mining; power line construction; gravel pit expansion; road building; fencing; fuels reduction projects; wild horse/burro gathers; and noxious weed treatments. These activities involve isolated and usually limited soil and vegetation disturbance or loss, but cumulative impacts could include increased fragmentation of wild horse/burro habitat and cumulative increases in vegetation and soil disturbances, which result in incremental losses in the quality and quantity of habitat available to wild horses/burros, as well as increase risks for erosion and noxious weed invasion. These activities can also impact wild horse/burro distribution and seasonal movement throughout and between HMAs. Each activity could result in incremental restrictions to free roaming behavior of wild horses and burros and over time may influence habitat use patterns, genetic interchange and use of water sources. According to the RFD scenario it is unlikely that large areas of disturbance would occur within the parcels offered for lease. Exploration and production proposals would be subject to further project-specific analysis, and mitigation measures, COAs and concurrent reclamation applied to avoid or reduce impacts. The Riparian Habitat and Riparian Habitat Buffer stipulations and Slopes >30% stipulations would help to decrease the habitat fragmentation or changes to distribution and movement patterns that could result from loss of water sources and forage; impacts to herd health and genetic interchange would be reduced as a result of fewer effects on distribution. For these reasons, the Proposed Action's contribution to cumulative effects are anticipated to be minimal.

4.2.8 Cumulative Effects to Grazing Management

The disturbance associated with geothermal exploration and production would add to the disturbances from mining activities and off-highway vehicle use. Creating new roads, constructing drill pads and developing wells and mines removes available forage, which could impact ranching operations. However, based on the RFD scenario (Appendix G), the cumulative impacts of the proposed action on rangeland resources are expected to be minimal due to the relatively small area of disturbance, concurrent reclamation and site-specific mitigation.

4.2.9 Cumulative Effects to Cultural Resources

The Proposed Action does not authorize any ground disturbance and therefore has no direct effect to cultural resources; however, the reasonably foreseeable role of geothermal exploration and development could cumulatively result in adverse effects to cultural resources. Several ongoing and potential actions in the area, such as mining, mineral and geothermal exploration, off-highway vehicle use, and livestock grazing, have the potential to cumulatively impact cultural resources. The majority of parcels nominated for this lease sale have not been inventoried for cultural resources; therefore, the types of resources that may be present in any particular area within parcels are unknown. A CESA cannot be defined for cultural resources until the presence of such resources is known. A Class III cultural resources inventory would be required prior to development within parcels. Once an inventory is completed, the geographic and temporal scope for analysis would be defined, followed by an analysis to determine what, if any, impacts there would be to cultural resources resulting from past, present, or reasonably-foreseeable actions within the CESA. Appropriate mitigation, BMPs, and COAs would be implemented to resolve any adverse effects to historic properties.

4.2.10 Cumulative Effects to Native American Cultural Concerns

Fluid mineral leasing and exploration may affect sites and associated activities of a cultural, traditional and spiritual nature. Potential residual effects of any surface occupancy that results from geothermal

leasing may be cumulative with other past and present actions and RFFAs. Presently, impacts to many cultural, traditional, spiritual sites and associated activities have been avoided through Native American consultation efforts. In accordance with the National Historic Preservation Act (P.L. 89-665), the National Environmental Policy Act (P.L. 91-190), the Federal Land Policy and Management Act (P. L.94-579), the American Indian Religious Freedom Act (P.L. 95-341), the Native American Graves Protection and Repatriation Act (P.L.101-601) and Executive Order 13007, the BLM must also provide affected tribes an opportunity to comment and consult on proposed actions. BLM must attempt to limit, reduce, or possibly eliminate any negative impacts to Native American traditional/cultural/spiritual sites, activities, and resources. Only the potential impacts to tribal resources were analyzed in this EA because it evaluates the leasing of geothermal parcels, not specific areas of proposed surface disturbance. If, as a result of leasing, a ground disturbing plan to explore or develop is submitted to BLM, all applicable laws, regulations, directives, SOPs, and stipulations and limitations would apply. BLM would work with the operator to mitigate effects to traditional/ cultural or religious sites on activities associated with any surface occupancy that results from geothermal leasing. Consequently, the BLM must take steps to identify locations having traditional/cultural or religious values to Native Americans and ensure that its actions do not unduly or unnecessarily burden the pursuit of traditional religion or traditional values. If specific concerns are identified, a thorough cumulative effects analysis would be part of the additional project-specific, site-specific NEPA analysis conducted at that time.

4.2.11 Cumulative Effects to Recreation, Visual Resources, and Wilderness Characteristics

Past and present actions and RFFAs with the greatest potential to affect recreation include geothermal exploration and development, mineral exploration and mining, gravel pit development and production, wind power construction, communication site construction, and road building. Given that many outdoor recreation activities are dependent upon a high quality visual/aesthetic environment, such developments, including fluid mineral development, have the potential to cumulatively lower the quality of recreational experiences in the Analysis Area. A reduction in opportunity for primitive and unconfined recreation would affect wilderness characteristics. These developments could also affect wilderness characteristics by reducing the appearance of naturalness, opportunities for solitude, and the extent of roadless area. However, given the RFD scenario for fluid minerals, other existing and foreseeable developments, any mitigation measures developed during additional site-specific analysis, and required reclamation (re-contouring and revegetation) of any abandoned projects, it is not anticipated that the quality of recreational experiences or the extent of wilderness characteristics would be substantially reduced overall.

Increased commercial development could slightly increase the area's population, which would create an increase in numbers of recreationists. Examples would be visits to WSAs, hunting and OHV use. This could affect wilderness characteristics by reducing opportunity for solitude.

The cumulative impacts to visual resources remain low to moderate due to the likelihood of large distances between actions and limited surface disturbance. Most of the future activities would be on valley floors. Visual resources are mitigated on a case-by-case basis and many of the activities would be temporary, with visual contrasts essentially eliminated when reclamation (re-contouring and revegetation) is completed, also eliminating impacts to the appearance of naturalness.

4.2.12 Cumulative Effects to Geology and Minerals, Land Use Authorizations

There is little appreciable potential for exploration or development resulting from the Proposed Action to have substantial cumulative impacts, combined with past and present actions and RFFAs, to geology and minerals or land use authorizations. Based on the RFD scenario, only a small percentage of acres of constructed roads associated with exploration/development would potentially remain after 10 years. The likelihood of other resources being present at the same location is minor, although not impossible, and methods are in place to co-develop resources. Since fluid and solid minerals are non-renewable resources, the combined effects of producing either or both would result in mineral depletion. However, considering the RFD scenario and that site-specific mitigation measures would be required for exploration and development, the Proposed Action's contribution to cumulative impacts would not be substantial.

4.2.13 Cumulative Effects to Socioeconomic Values

As described in Section 3.2.18, it is expected that the socioeconomic effects of the Proposed Action would be minor and beneficial. The same would be expected for cumulative effects. Specific information regarding the timing, duration, and level of employment is not available for other RFFAs that may occur within the CESA, precluding a comprehensive analysis of potential cumulative socioeconomic impacts. Additional project-specific analysis would be required for any future exploration or development project, including socioeconomics and environmental justice effects.

4.2.14 Cumulative Effects to Waste, Hazardous and Solid

Other major activities potentially generating hazardous and solid waste include mining, mineral, geothermal, and existing geothermal exploration, development and production projects. Given the small acreage of geothermal activity disturbance identified in the RFD (Appendix G), as well as any mitigation developed during additional site-specific analysis for geothermal exploration and development, the contribution to cumulative impacts would be negligible. Also, federal and state governments specifically regulate each project to ensure that there are no releases of hazardous materials, hazardous waste or solid waste into the environment. As discussed in Section 3.2.19, a slight risk of accidental spillage exists, and the consequences of any spill would be greater in wetlands, springs/seeps, riparian areas, floodplains and seasonally flooded playas. Standard lease notices and stipulations would generally prevent direct or indirect contamination of these areas.

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List of Preparers

Resources	Specialists
Cultural Resources and Paleontology	Jonah Blustain
Native American Cultural Concerns	Juan Martinez
Land Use Authorizations	Wendy Seley
Recreation, Visual Resources, Wilderness Characteristics	David Hullum
Geology and Minerals	Melissa Jennings
Waste, Hazardous and Solid	Earl Numinen
Soils, Vegetation, Rangeland Resources	Daltrey Balmer, Robert Burdick
Noxious Weeds, Invasive Non-native Species; Forestry	Anna O'Brien
Air Quality, Climate Change, Greenhouse Gases	Alex Jensen
Water Resources	Justin Ferris
Wildlife Resources and Special Status Species	Brandon Crosby, Elin Pierce
Wild Horses and Burros	Beth Freniere
Socioeconomic Values	Julie Suhr-Pierce
NEPA compliance	Melissa Jennings

Appendix A: List of Nominated Parcels

NV-19-09-026 240.000 Acres

T.0110N, R.0430E, 21 MDM, NV
 Sec. 008 SENE, E2SW,
 N2SE, SWSE;

Nye County
 Battle Mountain DO

NV-19-09-027 640.000 Acres

T.0010S, R.0400E, 21 MDM, NV
 Sec. 024 ALL;

Esmeralda County
 Battle Mountain DO

GEO NOM NVN-093688

NV-19-09-052 2482.000 Acres

T.0010N, R.0360E, 21 MDM, NV
 Sec. 036 PROT ALL;
 T.0010N, R.0370E, 21 MDM, NV
 Sec. 031 PROT ALL;
 032 PROT ALL;
 T.0010S, R.0370E, 21 MDM, NV
 Sec. 006 PROT ALL;

Esmeralda County
 Battle Mountain DO

GEO NOM NVN-97451

NV-19-09-132 960.000 Acres

T.0310N, R.0470E, 21 MDM, NV
 Sec. 010 E2;
 012 ALL;

Lander County
 Battle Mountain DO

GEO NOM NVN-097475

NV-19-09-133 668.000 Acres

T.0300N, R.0470E, 21 MDM, NV
 Sec. 002 LOTS 1-4;
 002 S2NE, S2NW, S2;

Lander County
 Battle Mountain DO

GEO NOM NVN-097475

NV-19-09-136 657.680 Acres

T.0310N, R.0470E, 21 MDM, NV
 Sec. 002 LOTS 5-44;
 002 S2NE, S2NW, S2;

Lander County
 Battle Mountain DO

GEO NOM NVN-097474

NV-19-09-137 1342.420 Acres

T.0300N, R.0480E, 21 MDM, NV
 Sec. 006 LOTS 1-3;
 T.0310N, R.0480E, 21 MDM, NV
 Sec. 006 LOTS 1-7;
 006 S2NE, SENW, E2SW, SE;
 030 LOTS 1-4;
 030 E2, E2NW, E2SW;

Lander County
 Battle Mountain DO

GEO NOM NVN-097474

GEO NOM NVN-097473

NV-19-09-140 600.400 Acres

T.0320N, R.0480E, 21 MDM, NV
 Sec. 030 LOTS 1-4;
 030 E2, E2NW, E2SW;

Lander County
 Battle Mountain DO

GEO NOM NVN-09747

Number of Parcels - 8

Total Acreage - 7,590.50

Any portion of the listed lands
 may be deleted upon determination
 that such lands are not available
 for leasing.

Appendix B: Stipulations and Lease Notices

BLM Nevada Standard Lease Notices (NV-B-00-A-LN)

These lease notices apply to all parcels all lands and represent standard Best Management Practices for ensuring compliance with extant Federal Laws and resource protection.

T&E, Sensitive and Special Status Species

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

Migratory Birds

The Operator is responsible for compliance with provisions of the Migratory Bird Treaty Act by implementing measures to prevent take of migratory birds. Operators should be aware that any ground clearing or other disturbance (such as creating cross-country access to sites, drilling, and/or construction) during the migratory bird (including raptors) nesting season (March 1 - July 31) risks a violation of the Migratory Bird Treaty Act. Disturbance to nesting migratory birds should be avoided by conducting surface disturbing activities outside the migratory bird nesting season.

If surface disturbing activities must be implemented during the nesting season, a preconstruction survey for nesting migratory birds should be performed by a qualified wildlife biologist, during the breeding season (if work is not completed within a specified time frame, then additional surveys may be needed). If active nests are found, an appropriately-sized no surface disturbance buffer determined in coordination with the BLM biologist should be placed on the active nest until the nesting attempt has been completed. If no active nests are found, construction activities must occur within the survey validity time frame specified in the conditions of approval.

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 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.

Fossils

This area has low to moderate potential for vertebrate paleontological resources, unless noted to have higher potential in a separate stipulation. This area may contain vertebrate paleontological resources. Inventory and/or on-site monitoring during disturbance or spot checking may be required of the operator. In the event that previously undiscovered paleontological resources are discovered in the performance of any surface disturbing activities, the item(s) or condition(s) will be left intact and immediately brought to the attention of the authorized officer of the BLM. Operations within 250 feet of any such discovery will not be resumed until written authorization to proceed is issued by the Authorized Officer. The lessee will bear the cost of any required paleontological appraisals, surface collection of fossils, or salvage of any large conspicuous fossils of significant scientific interest discovered during the operations.

Water

The Operator is responsible for compliance with provisions of the Clean Water Act, Safe Drinking Water Act, and applicable State laws and regulations regarding protection of state water resources. Operators should contact Nevada Division of Water Resources and Nevada Division of Environmental Protection regarding necessary permits and compliance measures for any construction or other activities.

Mining Claims

This parcel may contain existing mining claims and/or mill sites located under the 1872 Mining Law. To the extent it does, the oil and gas lessee must conduct its operations, so far as reasonably practicable, to avoid damage to any known deposit of any mineral for which any mining claim on this parcel is located, and should not endanger or unreasonably or materially interfere with the mining claimant's operations, including any existing surface or underground improvements, workings, or facilities which may have been made for the purpose of mining operations. The provisions of the Multiple Mineral Development Act (30 U.S.C. 521 et seq.) shall apply on the leased lands.

Fire

The following precautionary measures should be taken to prevent wildland fires. In the event your operations should start a fire, you could be held liable for all suppression costs.

- All vehicles should carry fire extinguishers and a minimum of 10 gallons of water.
- Adequate fire-fighting equipment i.e. shovel, pulaski, extinguisher(s) and a minimum 10 gallons of water should be kept at the drill site(s).
- Vehicle catalytic converters should be inspected often and cleaned of all brush and grass debris.
- When conducting welding operations, they should be conducted in an area free from or mostly free from vegetation. A minimum of 10 gallons water and a shovel should be on hand to extinguish any fires created from the sparks. Extra personnel should be at the welding site to watch for fires created by welding sparks.
- Report wildland fires immediately to the BLM Central Nevada Interagency Dispatch Center (CNIDC) at (775) 623-3444. Helpful information to reported is location (latitude and longitude if possible), what's burning, time started, who/what is near the fire and direction of fire spread.

- When conducting operations during the months of May through September, the operator must contact the BLM Battle Mountain District Office, Division of Fire and Aviation at (775) 635-4000 to find out about any fire restrictions in place for the area of operation and to advise this office of approximate beginning and ending dates for your activities.

**Pronghorn Antelope Seasonal Habitat
(#NV-B-01-A-TL)**

Stipulation: Timing Limitation (TL) -No surface activity within Pronghorn Antelope crucial winter habitat from November 1 through March 31.

Objective [Purpose]: To protect Pronghorn Antelope crucial winter habitat necessary to maintaining the critical life stages of Pronghorn wildlife populations.

Exception: The Authorized Officer may grant an exception if an environmental review determines that the action, as proposed or otherwise restricted, does not adversely affect the Pronghorn Antelope and its habitat. An exception may also be granted if the proponent, BLM, and other affected interests negotiate mitigation that would satisfactorily offset the anticipated impacts to Pronghorn Antelope and its habitat. An exception may be granted for actions designed to enhance the long-term utility or availability of the habitat.

Modification: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with Nevada Department of Wildlife, determines that portions of the area no longer contain the Crucial Winter pronghorn habitat or that the proposed action would not affect the species and habitat. The dates for the timing restriction may also be modified by the Authorized Officer if new information indicates the dates are not valid for the leasehold.

Waiver: The restriction may be waived by the Authorized Officer if it is determined that the described lands do not contain suitable pronghorn habitat, or are otherwise incapable of serving the requirements of for the species and therefore no longer warrant consideration as a component necessary for their protection.

NV-B-01-A-TL	Pronghorn Seasonal Habitat
Parcel #	Legal Land Description
NV-19-09-026	ALL LANDS
NV-19-09-133	ALL LANDS
NV-19-09-137	T. 0310 N, R. 0480 E, 21 MDM, NV Sec. 030 LOT 4, SESW; T.0310N, R.0480E, 21 MDM, NV Sec. 006 LOTS 1-3; 006 E2NW, N2NE;
NV-19-09-140	T.0320 N, R. 0480 E, 21 MDM, NV Sec. 030 ALL LANDS;

**Mule Deer Seasonal Habitat
(#NV-B-02-A-TL)**

Stipulation: Timing Limitation (TL) -No surface activity within winter habitat from January 15 through May 15.

Objective [Purpose]: To protect mule deer winter habitat necessary to maintaining the critical life stages of Mule Deer wildlife populations.

Exception: The Authorized Officer may grant an exception if an environmental review determines that the action, as proposed or otherwise restricted, does not adversely affect the Mule Deer and its habitat. An exception may also be granted if the proponent, BLM, and other affected interests negotiate mitigation that would satisfactorily offset the anticipated impacts the Mule Deer and its habitat. An exception may be granted for actions designed to enhance the long-term utility or availability of the habitat.

Modification: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with Nevada Department of Wildlife, determines that portions of the area no longer contain the winter mule deer habitat or that the proposed action would not affect the species and habitat. The dates for the timing restriction may also be modified by the Authorized Officer if new information indicates the dates are not valid for the leasehold.

Waiver: The restriction may be waived by the Authorized Officer if it is determined that the described lands do not contain suitable Mule Deer habitat, or are otherwise incapable of serving the requirements of for the species and therefore no longer warrant consideration as a component necessary for their protection.

NV-B-02-A-TL	Mule Deer Seasonal Habitat
Parcel #	Legal Land Description
NV-19-09-132	T. 0310 N, R. 0470 E, 21 MDM, NV Sec. 010 ALL LANDS; 012 NWNW;
NV-19-09-133	T. 0300 N, R. 0470 E, 21 MDM, NV Sec. 002 ALL LANDS;
NV-19-09-136	T. 0310 N, R. 0470 E, 21 MDM, NV Sec. 002 ALL LANDS;
NV-19-09-137	T. 0310 N, R. 0480 E, 21 MDM, NV Sec. 030 LOTS 1-4, E2W2, NE, NWSE;
NV-19-09-140	T.0320 N, R. 0480 E, 21 MDM, NV Sec. 030 ALL LANDS;

**Mule Deer Movement Corridors
(#NV-B-02-B-TL)**

Stipulation: Timing Limitation (TL) -No surface activity within Mule Deer movement corridors from November 1 through April 30.

Objective [Purpose]: To protect mule deer migration corridors necessary to maintaining the critical life stages of Mule Deer wildlife populations.

Exception: The Authorized Officer may grant an exception if an environmental review determines that the action, as proposed or otherwise restricted, does not adversely affect the Mule Deer and its habitat. An exception may also be granted if the proponent, BLM, and other affected interests negotiate mitigation that would satisfactorily offset the anticipated impacts to Mule Deer and its habitat. An exception may be granted for actions designed to enhance the long-term utility or availability of the habitat.

Modification: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with Nevada Department of Wildlife, determines that portions of the area no longer contain the Mule Deer movement corridor or that the proposed action would not affect the species and habitat. The dates for the timing restriction may also be modified by the Authorized officer if new information indicates the dates are not valid for the leasehold.

Waiver: No waiver.

NV-B-02-B-TL	Mule Deer Seasonal Habitat
Parcel #	Legal Land Description
NV-19-09-026	T.0110N, R.0430E, 21 MDM, NV Sec. 008 SENE, E2SW, N2SE, SWSE;

**Bighorn Sheep Year Round Habitat
(#NV-B-04-A-CSU)**

Stipulation: Controlled Surface Use (CSU) applies to lands within bighorn year round occupied habitat. Surface occupancy or use is subject to the following special operating constraint:

Objective [Purpose]: To protect bighorn sheep year round occupied habitat necessary to maintaining the critical life stages of bighorn sheep populations.

Exception: The Authorized Officer may grant an exception if an environmental review determines that the action, as proposed or otherwise restricted, does not adversely affect the Bighorn Sheep and its habitat. An exception may also be granted if the proponent, BLM, and other affected interests negotiate mitigation that would satisfactorily offset the anticipated impacts. An exception may be granted for actions designed to enhance the long-term utility or availability of the habitat.

Modification: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with Nevada Department of Wildlife, determines that portions of the area no longer contain the habitat or that the proposed action would not affect the species and habitat. The dates for the timing restriction may also be modified if new information indicates the dates are not valid for the leasehold.

Waiver: The restriction may be waived if it is determined that the described lands do not contain suitable habitat, or are otherwise incapable of serving the requirements of for the species and therefore no longer warrant consideration as a component necessary for their protection. In certain instances this determination would come after consulting with other managing agencies or interested publics.

NV-B-04-A-CSU	Bighorn Sheep Year Round Habitat
Parcel #	Legal Land Description
NV-19-09-052	T.0010N, R.0370E, 21 MDM, NV Sec. 031 PROT ALL; 032 PROT ALL;

**Bighorn Sheep Lambing/Crucial Winter Range Habitat
(#NV-B-04-B-TL)**

Stipulation: Timing Limitation (TL) -No surface activity within bighorn lambing/crucial winter range from November 1 through March 31 for Desert Bighorn and from November 1 through May 15 for California and Rocky Mountain Bighorn Sheep

Objective [Purpose]: To protect bighorn sheep from disturbance during the lambing/crucial winter habitat necessary to maintaining the critical life stages of bighorn sheep wildlife populations.

Exception: The Authorized Officer may grant an exception if an environmental review determines that the action, as proposed or otherwise restricted, does not adversely affect the Bighorn Sheep and its lambing and crucial winter range. An exception may also be granted if the proponent, BLM, and other affected interests negotiate mitigation that would satisfactorily offset the anticipated impacts. An exception may be granted for actions designed to enhance the long-term utility or availability of the habitat.

Modification: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with Nevada Department of Wildlife, determines that portions of the area no longer contain the habitat or that the proposed action would not affect the species and habitat. The dates for the timing restriction may also be modified if new information indicates the dates are not valid for the leasehold.

Waiver: The restriction may be waived if it is determined that the described lands do not contain suitable habitat, or are otherwise incapable of serving the requirements of for the species and therefore no longer warrant consideration as a component necessary for their protection. In certain instances this determination would come after consulting with other managing agencies or interested publics.

NV-B-04-B-TL	Bighorn Sheep Lambing/Crucial Winter Range Habitat
Parcel #	Legal Land Description
NV-19-09-027	T. 0010 S, R. 0400 E, 21 MDM, NV Sec. 024 E2E2;

**Lease Notice - Wild Horse and Burro
(#NV-B-05-A-LN)**

Wild horse or burro herds are known to use some or all of the proposed lease area. If proposed fluid mineral activities are to occur in a herd management area (HMA) or a Herd Area (HA) the BLM Authorized Officer may identify mitigation measures necessary for reducing adverse impacts to wild horses and/or burros. These measures would be designed in a manner that does not hinder the wild and free-roaming behavior of the horses and burros and may include, but are not limited to, providing alternative water sources for horses of equal quality and quantity as well as fencing to prevent access to project area. Additional specific measures to protect horses and burros may be developed during review of proposals.

NV-B-05-A-LN	Wild Horse and Burro
Parcel #	Legal Land Description
NV-19-09-027	ALL LANDS;
NV-19-09-052	ALL LANDS;

**Raptor Nest Sites
(NV-B-06-B-TL)**

Stipulation: Timing Limitation. No surface activity from [insert date] through [insert date] within 0.5 mile of a raptor nest site which has been active within the past five years.

Objective [Purpose]: To protect raptor nesting activities necessary to maintaining the critical life stages of existing raptor populations.

Exception: The Authorized Officer may grant an exception if an environmental review determines that the action, as proposed or otherwise restricted, does not adversely affect raptor nest sites being protected by the restriction. An exception may also be granted if the proponent, BLM, and other affected interests, in consultation with Nevada Department of Wildlife, negotiate mitigation that would satisfactorily offset the anticipated impacts. An exception may be granted for actions designed to enhance the long-term utility or availability of the habitat.

Modification: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with Nevada Department of Wildlife, determines that portions of the area can be occupied without adversely affecting raptor nesting activity. The dates for the timing restriction may be modified if new information indicates the dates are not valid for the leasehold.

Waiver: The stipulation may be waived if the authorized officer, in consultation with Nevada Department of Wildlife determines that the entire leasehold no longer contains raptor nest sites.

NV-B-06-B-TL	Raptor Nest Sites
Parcel #	Legal Land Description
NV-19-09-027	T. 0100 S, R. 0400 E, 21 MDM, NV Sec. 024 SE;
NV-19-09-133	T. 0300 N, R. 0470 E, 21 MDM, NV Sec. 002 S2SW;
NV-19-09-137	T. 0310 N, R. 0480 E, 21 MDM, NV Sec. 030 LOTS 1-2, E2NW;

Riparian Habitat
(#NV-B-10-A-NSO)

Stipulation: No Surface Occupancy (NSO) on and within riparian-wetland vegetated areas to protect the values and functions of these areas.

Objective [Purpose]: To protect the values and functions of riparian and wetland areas based on the nature, extent, and value of the area potentially affected.

Exception: The Authorized Officer may grant an exception if an environmental review determines that the action, as proposed or otherwise restricted, does not affect the resource. An exception may also be granted if the proponent, BLM, and other affected interests (e.g. NDOW) negotiate mitigation that would satisfactorily offset the anticipated negative impacts. An exception may be granted for actions designed to enhance the long-term utility or availability of the riparian habitat.

Modification: The Authorized Officer may modify the size and shape of the restricted area if an environmental analysis indicates the actual suitability of the land for the resource differs from that in the otherwise applicable restriction.

Waiver: The restriction may be waived if it is determined that the described lands do not contain the subject resource, or are incapable of serving the requirements of the resource and therefore no longer warrant consideration as a component necessary for protection of the resource.

Parcel #	Legal Land Description
NV-19-09-027	T. 0010 S, R. 0400 E, 21 MDM, NV Sec. 024 ALL;

Riparian Habitat Buffer
(#NV-B-10-B-CSU)

Stipulation: Controlled Surface Use (CSU) will be applied within 500 feet of riparian-wetland vegetation to protect the values and functions of these areas. An engineering plan or a study may be required by the operator that identifies the extent of the resource or how the resource will be managed or protected.

Objective [Purpose]: To protect the values and functions of riparian and wetland areas based on the nature, extent, and value of the area potentially affected.

Exception: The Authorized Officer may grant an exception if an environmental review determines that the action, as proposed or otherwise restricted, does not affect the resource. An exception may also be granted if the proponent, BLM, and other affected interests (e.g. NDOW) negotiate mitigation that would satisfactorily offset the anticipated negative impacts. An exception may be granted for actions designed to enhance the long-term utility or availability of the riparian habitat.

Modification: The Authorized Officer may modify the size and shape of the restricted area if an environmental analysis indicates the actual suitability of the land for the resource differs from that in the otherwise applicable restriction.

Waiver: The restriction may be waived if it is determined that the described lands do not contain the subject resource, or are incapable of serving the requirements of the resource and therefore no longer warrant consideration as a component necessary for protection of the resource.

Parcel #	Legal Land Description
NV-19-09-027	T. 0010 S, R. 0400 E, 21 MDM, NV Sec. 024 ALL;

Soil Slopes > 30 and < 41 percent
(#NV-B-11-A-CSU)

Stipulation: Controlled Surface Use (CSU) applies to lands with slopes greater than 30 percent and less than 41 percent. An engineering/reclamation plan must be submitted by the applicant and approved by the BLM Authorized Officer before any surface disturbance can occur.

The plan must demonstrate to the Authorized Officer's satisfaction how the operator will meet the following performance standards:

- Soil stability is maintained preventing slope failure and wind or water erosion.
- The site will be stable with no evidence of accelerated erosion features.
- The rate of soil erosion will be controlled to maintain or improve soil quality and sustainability. The disturbed soils shall have characteristics that approximate the reference site with regard to quantitative and qualitative soil erosion indicators described in H-7100-1 Soil Inventory, Monitoring, and Management Handbook.
- Sufficient topsoil is maintained for ensuring successful final reclamation. How interim reclamation will be completed for producing well locations and long-term roads, including the re-spreading of all salvaged topsoil over the areas of interim reclamation.
- The original landform and site productivity will be partially restored during interim reclamation and fully restored as a result of final reclamation.

Objective [Purpose]: To maintain soil productivity, provide necessary protection to prevent excessive soil erosion on steep slopes, to avoid areas subject to slope failure, mass wasting, piping, or having excessive reclamation problems, and to ensure successful interim and final reclamation.

Exception: An exception may be granted if the operator can demonstrate in a plan of operations that adverse effects can be minimized and activities safely conducted.

Modification: The area affected by this stipulation may be modified by the authorized officer if it is determined that portions of the area do not include slopes over 30 percent, or the operator can demonstrate in a plan of operations that adverse effects can be minimized. The authorized officer may modify the size and shape of the restricted area subject to the stipulation based upon a Natural Resource Conservation Service (NRCS) soil survey or BLM evaluation. The stipulation and performance standards identified above may also be modified based on negative or positive monitoring results from similar proposed actions on similar sites or increased national or state performance standards.

Waiver: This stipulation can be waived by the authorized officer if it is determined that none of the leasehold includes slopes over 30 percent.

NV-B-11-A-CSU	Soil Slopes > 30 and < 41 percent
Parcel #	Legal Land Description
NV-19-09-027	T.0010S, R.0400E, 21 MDM, NV Sec.024 W2SE;
NV-19-09-052	T.0010N, R.0360E, 21 MDM, NV Sec. 036 SE; T.0010N, R.0370E, 21 MDM, NV Sec.031 N2NE; Sec.032 N2NW, SENE, SESE; T.0010S, R.0370E, 21 MDM, NV Sec.006 N2NW, S2SW, SWSE;
NV-19-09-133	T. 0300 N, R. 0470 E, 21 MDM, NV Sec. 002 Lots 1-2, S2NW, SWSW;
NV-19-09-136	T. 0300 N, R. 0470 E, 21 MDM, NV Sec. 002 SWNE, NWNE, NESW;

**Soil Slopes >40 percent
(#NV-B-11-B-NSO)**

Stipulation: No Surface Occupancy (NSO) on slopes greater than 40 percent.

Objective [Purpose]: To maintain soil productivity, provide necessary protection to prevent excessive soil erosion on steep slopes, to avoid areas subject to slope failure, mass wasting, piping, or having excessive reclamation problems.

Exception: The Authorized Officer may grant an exception if a staff review determines that the proposed action is of a scale (pipeline, vs. road, vs. well pad) or sited in a location or a site specific evaluation determines that the slope would not result in mass slope failure or accelerated erosion and the operator would be able to meet BLM's reclamation standards.

Modification: The Authorized Officer may modify the area subject to the stipulation based upon a BLM evaluation of the area. The stipulation and performance standards identified above may also be modified based on negative or positive monitoring results from similar proposed actions on similar sites or increased national or state performance standards.

Waiver: The restriction may be waived if it is determined that the described lands do not include lands with slopes greater than 40 percent. This determination shall be based upon USGS mapping and a BLM evaluation of the area.

NV-B-11-B-NSO	Soil Slopes >40 percent
Parcel #	Legal Land Description
NV-19-09-027	T.0010S, R.0400E, 21 MDM, NV Sec.024 E2E2;
NV-19-09-052	T.0010N, R.0360E, 21 MDM, NV Sec. 036 SE; T.0010N, R.0370E, 21 MDM, NV Sec.031 SWNW; Sec.032 NENE, SESE;
NV-19-09-133	T. 0300 N, R. 0470 E, 21 MDM, NV Sec. 002 N2NW, NWSW;
NV-19-09-136	T. 0310 N, R. 0480 E, 21 MDM, NV Sec. 002 NENE;

**Lease Notice – Existing Right of Way
(#NV-B-13-A-LN)**

This parcel contains one or more existing Rights of Way (ROW). For more information regarding these ROWs, please contact [Wendy Seley 775-482-7805].

The lessee accepts this lease subject to the right of individuals, authorized by Bureau of Land Management District Office, to access, operate within, and maintain the ROW as described in case file(s) (see below). The lessee agrees that its operations will not interfere with the use of the ROW(s) by these individuals.

NV-B-13-A-LN	Existing Right of Way
Parcel #	Legal Land Description
NV-19-09-027	T.0010S, R.0400E, 21 MDM, NV Sec. 024 NWNW, SWSW;
NV-19-09-052	T.0010N, R.0360E, 21 MDM, NV Sec. 036 PROT E2W2, NWSW, SWNE, NENE;
NV-19-09-132	T.0310N, R.0470E, 21 MDM, NV Sec. 010 E2E2; 012 SWNW, E2NW, W2NE, NENW;
NV-19-09-136	T.0310N, R.0470E, 21 MDM, NV Sec. 002 LOTS 10, 12-13; 002 S2S2;
NV-19-09-137	T.0300N, R.0480E, 21 MDM, NV Sec. 006 LOTS 1-3; T.0310N, R.0480E, 21 MDM, NV Sec. 006 LOT 4; 006 S2S2;

**Lease Notice – Existing Geothermal Wells
(#NV-B-15-A-LN)**

This parcel contains one or more shut-in geothermal wells. For more information regarding these wells, please contact [Tonopah Field Office at 775-482-7800].

The successful bidder will be recognized as the operator of the well and will be responsible for complying with all applicable regulations. Prior to issuance of the lease for this parcel, the successful bidder must provide adequate bond coverage in accordance with 43 CFR 3214.

NV-B-15-A-LN	Existing Geothermal Wells
Parcel #	Legal Land Description
NV-19-09-052	T.0010N, R.0360E, 21 MDM, NV Sec. 031 SWSW;

**Stipulation – Sage-Grouse Habitat, GHMA, Near Leks
(#NV-B-16-B-TL)**

Stipulation: Timing Limitation. In General Management Habitat Areas (GHMA) No Surface Activity would be allowed within 4.0 miles of active or pending Greater Sage-Grouse (GRSG) leks from March 1 through May 15.

Objective [Purpose]: To protect GRSG lekking habitat.

Exception: The State Director may grant an exception to the allocations and stipulations if one of the following applies (in coordination with NDOW, SETT):

- i. The location of the proposed authorization is determined to be unsuitable (by a biologist with GRSG experience using methods such as Stiver et al 2015) and lacks the ecological potential to become marginal or suitable habitat; and would not result in direct, indirect, or cumulative impacts on GRSG and its habitat. Management allocation decisions would not apply to those areas determined to be unsuitable because the area lacks the ecological potential to become marginal or suitable habitat, and/or
- ii. The proposed activity's impacts could be offset to result in no adverse impacts on GRSG or its habitat, through use of the mitigation hierarchy consistent with Federal law and the state's mitigation policies and programs, such as the State of Nevada's Executive Order 2018-32 (and any future regulations developed to implement this order). In cases where exceptions may be granted for projects with a residual impact, voluntary compensatory mitigation consistent with the State's mitigation policies and programs, such as the State of Nevada's Executive Order 2018-32 (and any future regulations developed to implement this order) would be one mechanism by which a proponent achieves the Approved RMP Amendment goals, objectives, and exception criteria. When a proponent volunteers compensatory mitigation as their chosen approach to address residual impacts, the BLM can incorporate those actions into the rationale used to grant an exception. The final decision to grant a waiver, exception, or modification would be based, in part, on criteria consistent with the State's GRSG management plans and policies.

Modification: The authorized officer, in coordination with the appropriate state wildlife agency (NDOW, and/or CDFW), can modify and/or waive dates for seasonal timing restrictions based on the criteria described below, based on site-specific information that indicates:

- i. A project proposal's NEPA analysis and/or project record, and correspondence from NDOW, demonstrates that any modification (shortening/extending seasonal timeframes or waiving the seasonal timing restrictions all together) is justified on the basis that it serves to better protect or enhance GRSG and its habitat than if the strict application of seasonal timing restrictions are implemented. Under this scenario modifications can occur if:
 - a) A proposed authorization would have beneficial or neutral impacts on GRSG and its habitat.
 - b) Topography or other factors eliminate direct and indirect impacts from visibility and audibility to GRSG and its habitat.
 - c) There are documented local variations (e.g., higher/lower elevations) and/or annual climatic fluctuations (e.g., early/late spring, long/heavy winter) that indicate the seasonal life cycle periods are different than presented, or that GRSG are not using the area during a given seasonal life cycle period.

- ii. Modifications are needed to address an immediate public health and safety concern in a timely manner (e.g., maintaining a road impacted by flooding).

Waiver: The stipulation may be waived if the authorized officer, in consultation with the appropriate state wildlife agency (NDOW), determines that the entire leasehold is within unsuitable habitat (see exceptions above) and would not result in direct, indirect, or cumulative impacts to GRSG and/or its habitat.

NV-B-16-B-TL	Sage Grouse, Habitat, GHMA, Near Leks
Parcel #	Legal Land Description
NV-19-09-133	T. 0300 N, R. 0470 E, 21 MDM, NV Sec. 002 W2;

**Stipulation – Sage-Grouse Habitat, GHMA, Winter
(#NV-B-16-C-TL)**

Stipulation: Timing Limitation. In General Management Habitat Areas (GHMA) No Surface Activity would be allowed within Greater Sage-Grouse (GRSG) winter habitat from November 1 through February 28.

Objective [Purpose]: To protect GRSG winter habitat.

Exception: The State Director may grant an exception to the allocations and stipulations if one of the following applies (in coordination with NDOW, SETT):

- i. The location of the proposed authorization is determined to be unsuitable (by a biologist with GRSG experience using methods such as Stiver et al 2015) and lacks the ecological potential to become marginal or suitable habitat; and would not result in direct, indirect, or cumulative impacts on GRSG and its habitat. Management allocation decisions would not apply to those areas determined to be unsuitable because the area lacks the ecological potential to become marginal or suitable habitat, and/or
- ii. The proposed activity's impacts could be offset to result in no adverse impacts on GRSG or its habitat, through use of the mitigation hierarchy consistent with Federal law and the state's mitigation policies and programs, such as the State of Nevada's Executive Order 2018-32 (and any future regulations developed to implement this order). In cases where exceptions may be granted for projects with a residual impact, voluntary compensatory mitigation consistent with the State's mitigation policies and programs, such as the State of Nevada's Executive Order 2018-32 (and any future regulations developed to implement this order) would be one mechanism by which a proponent achieves the Approved RMP Amendment goals, objectives, and exception criteria. When a proponent volunteers compensatory mitigation as their chosen approach to address residual impacts, the BLM can incorporate those actions into the rationale used to grant an exception. The final decision to grant a waiver, exception, or modification would be based, in part, on criteria consistent with the State's GRSG management plans and policies.

Modification: The authorized officer, in coordination with the appropriate state wildlife agency (NDOW, and/or CDFW), can modify and/or waive dates for seasonal timing restrictions based on the criteria described below, based on site-specific information that indicates:

- i. A project proposal's NEPA analysis and/or project record, and correspondence from NDOW, demonstrates that any modification (shortening/extending seasonal timeframes or waiving the seasonal timing restrictions all together) is justified on the basis that it serves to better protect or enhance GRSG and its habitat than if the strict application of seasonal timing restrictions are implemented. Under this scenario modifications can occur if:
 - a) A proposed authorization would have beneficial or neutral impacts on GRSG and its habitat.
 - b) Topography or other factors eliminate direct and indirect impacts from visibility and audibility to GRSG and its habitat.
 - c) There are documented local variations (e.g., higher/lower elevations) and/or annual climatic fluctuations (e.g., early/late spring, long/heavy winter) that indicate the seasonal life cycle periods are different than presented, or that GRSG are not using the area during a given seasonal life cycle period.
- ii. Modifications are needed to address an immediate public health and safety concern in a timely manner (e.g., maintaining a road impacted by flooding).

Waiver: The stipulation may be waived if the authorized officer, in consultation with the appropriate state wildlife agency (NDOW), determines that the entire leasehold is within unsuitable habitat (see exceptions above) and would not result in direct, indirect, or cumulative impacts to GRSG and/or its habitat.

NV-B-16-C-TL	Sage-Grouse Habitat, GHMA, Winter
Parcel #	Legal Land Description
NV-19-09-133	T. 0300 N, R. 0470 E, 21 MDM, NV Sec. 002 W2;
NV-19-09-140	T. 0320 N, R. 0480 E, 21 MDM, NV Sec. 30 LOTS 1-2;

**Stipulation – Sage-Grouse Habitat, GHMA, Early Brood-Rearing
(#NV-B-16-D-TL)**

Stipulation: Timing Limitation. No Surface Occupancy (NSO) would be allowed in Greater Sage-Grouse (GRSG) early brood-rearing habitat from May 15 through June 15.

Objective [Purpose]: To provide seasonal protection to GRSG early brood-rearing habitat in General Management Habitat Areas (GHMA).

Exception: The State Director may grant an exception to the allocations and stipulations if one of the following applies (in coordination with NDOW, SETT):

- i. The location of the proposed authorization is determined to be unsuitable (by a biologist with GRSG experience using methods such as Stiver et al 2015) and lacks the ecological potential to become marginal or suitable habitat; and would not result in direct, indirect, or cumulative impacts on GRSG and its habitat. Management allocation decisions would not apply to those areas determined to be unsuitable because the area lacks the ecological potential to become marginal or suitable habitat, and/or
- ii. The proposed activity's impacts could be offset to result in no adverse impacts on GRSG or its habitat, through use of the mitigation hierarchy consistent with Federal law and the state's

mitigation policies and programs, such as the State of Nevada's Executive Order 2018-32 (and any future regulations developed to implement this order). In cases where exceptions may be granted for projects with a residual impact, voluntary compensatory mitigation consistent with the State's mitigation policies and programs, such as the State of Nevada's Executive Order 2018-32 (and any future regulations developed to implement this order) would be one mechanism by which a proponent achieves the Approved RMP Amendment goals, objectives, and exception criteria. When a proponent volunteers compensatory mitigation as their chosen approach to address residual impacts, the BLM can incorporate those actions into the rationale used to grant an exception. The final decision to grant a waiver, exception, or modification would be based, in part, on criteria consistent with the State's GRSG management plans and policies.

Modification: The authorized officer, in coordination with the appropriate state wildlife agency (NDOW, and/or CDFW), can modify and/or waive dates for seasonal timing restrictions based on the criteria described below, based on site-specific information that indicates:

- i. A project proposal's NEPA analysis and/or project record, and correspondence from NDOW, demonstrates that any modification (shortening/extending seasonal timeframes or waiving the seasonal timing restrictions all together) is justified on the basis that it serves to better protect or enhance GRSG and its habitat than if the strict application of seasonal timing restrictions are implemented. Under this scenario modifications can occur if:
 - a) A proposed authorization would have beneficial or neutral impacts on GRSG and its habitat.
 - b) Topography or other factors eliminate direct and indirect impacts from visibility and audibility to GRSG and its habitat.
 - c) There are documented local variations (e.g., higher/lower elevations) and/or annual climatic fluctuations (e.g., early/late spring, long/heavy winter) that indicate the seasonal life cycle periods are different than presented, or that GRSG are not using the area during a given seasonal life cycle period.
- ii. Modifications are needed to address an immediate public health and safety concern in a timely manner (e.g., maintaining a road impacted by flooding).

Waiver: The stipulation may be waived if the authorized officer, in consultation with the appropriate state wildlife agency (NDOW), determines that the entire leasehold is within unsuitable habitat (see exceptions above) and would not result in direct, indirect, or cumulative impacts to GRSG and/or its habitat.

NV-B-16-D-TL	Sage Grouse Habitat, GHMA, Early Brood-Rearing
Parcel #	Legal Land Description
NV-19-09-133	T. 0300 N, R. 0470 E, 21 MDM, NV Sec. 002 W2;

**Stipulation – Sage-Grouse Habitat, GHMA, Late Brood-Rearing
(#NV-B-16-E-TL)**

Stipulation: Timing Limitation. No Surface Occupancy (NSO) would be allowed in Greater Sage-Grouse (GRSG) late brood-rearing habitat from June 15 through September 15 in GHMA.

Objective [Purpose]: To provide seasonal protection to GRSG late brood-rearing habitat.

Exception: The State Director may grant an exception to the allocations and stipulations if one of the following applies (in coordination with NDOW, SETT):

- i. The location of the proposed authorization is determined to be unsuitable (by a biologist with GRSG experience using methods such as Stiver et al 2015) and lacks the ecological potential to become marginal or suitable habitat; and would not result in direct, indirect, or cumulative impacts on GRSG and its habitat. Management allocation decisions would not apply to those areas determined to be unsuitable because the area lacks the ecological potential to become marginal or suitable habitat, and/or
- ii. The proposed activity's impacts could be offset to result in no adverse impacts on GRSG or its habitat, through use of the mitigation hierarchy consistent with Federal law and the state's mitigation policies and programs, such as the State of Nevada's Executive Order 2018-32 (and any future regulations developed to implement this order). In cases where exceptions may be granted for projects with a residual impact, voluntary compensatory mitigation consistent with the State's mitigation policies and programs, such as the State of Nevada's Executive Order 2018-32 (and any future regulations developed to implement this order) would be one mechanism by which a proponent achieves the Approved RMP Amendment goals, objectives, and exception criteria. When a proponent volunteers compensatory mitigation as their chosen approach to address residual impacts, the BLM can incorporate those actions into the rationale used to grant an exception. The final decision to grant a waiver, exception, or modification would be based, in part, on criteria consistent with the State's GRSG management plans and policies.

Modification: The authorized officer, in coordination with the appropriate state wildlife agency (NDOW, and/or CDFW), can modify and/or waive dates for seasonal timing restrictions based on the criteria described below, based on site-specific information that indicates:

- i. A project proposal's NEPA analysis and/or project record, and correspondence from NDOW, demonstrates that any modification (shortening/extending seasonal timeframes or waiving the seasonal timing restrictions all together) is justified on the basis that it serves to better protect or enhance GRSG and its habitat than if the strict application of seasonal timing restrictions are implemented. Under this scenario modifications can occur if:
 - a) A proposed authorization would have beneficial or neutral impacts on GRSG and its habitat.
 - b) Topography or other factors eliminate direct and indirect impacts from visibility and audibility to GRSG and its habitat.
 - c) There are documented local variations (e.g., higher/lower elevations) and/or annual climatic fluctuations (e.g., early/late spring, long/heavy winter) that indicate the seasonal life cycle periods are different than presented, or that GRSG are not using the area during a given seasonal life cycle period.
- ii. Modifications are needed to address an immediate public health and safety concern in a timely manner (e.g., maintaining a road impacted by flooding).

Waiver: The stipulation may be waived if the authorized officer, in consultation with the appropriate state wildlife agency (NDOW), determines that the entire leasehold is within unsuitable habitat (see exceptions above) and would not result in direct, indirect, or cumulative impacts to GRSG and/or its habitat.

NV-B-16-E-TL	Sage-Grouse Habitat, GHMA, Late Brood-Rearing
Parcel #	Legal Land Description
NV-19-09-133	T. 0300 N, R. 0470 E, 21 MDM, NV Sec. 002 W2;

**Lease Notice – Sage-Grouse Habitat
(#NV-B-16-H-LN)**

According to the Nevada and Northeastern California Greater Sage-Grouse Approved Resource Management Plan Amendment (NVCA Approved GRSG RMP Amendment), specific Required Design Features (RDFs) are required for certain activities in all Greater Sage-Grouse (GRSG) habitats. RDFs establish the minimum specifications for certain activities to help mitigate adverse impacts. However, the applicability and overall effectiveness of each RDF cannot be fully assessed until the project level when the project location and design are known. Because of site-specific circumstances, some RDFs may not apply to some projects (e.g., a resource is not present on a given site) and/or may require slight variations (e.g., a larger or smaller protective area). All variations in RDFs would require that at least one of the following be demonstrated in the NEPA analysis associated with the project/activity:

- A specific RDF is documented to not be applicable to the site-specific conditions of the project/activity (e.g. due to site limitations or engineering considerations). Economic considerations, such as increased costs, do not necessarily require that an RDF be varied or rendered inapplicable;
- An alternative RDF is determined to provide equal or better protection for GRSG or its habitat;
- A specific RDF will provide no additional protection to GRSG or its habitat.

A list of the RDFs may be found in Appendix C of the NVCA Approved GRSG RMP Amendment; however application of the RDFs is site specific at the project proposal stage.

NV-B-16-H-LN	Sage-Grouse Habitat
Parcel #	Legal Land Description
NV-19-09-133	T. 0300 N, R. 0470 E, 21 MDM, NV Sec. 002 W2;
NV-19-09-140	T. 0320 N, R. 0480 E, 21 MDM, NV Sec. 30 LOTS 1-2;

Appendix C: Soil Types and Biotic Communities

Soil Types in the Analysis Area

Aridisols are soils that are too dry for the growth of mesophytic plants. The lack of moisture greatly restricts the intensity of weathering processes and limits most soil development processes affecting the uppermost layers of the soils. These soils often accumulate gypsum, salt, calcium carbonate, and other materials that are easily leached from soils in more humid environments. They have properties typical of soils in arid regions and are low in organic matter. Aridisols are mainly found in valley bottoms, but may occur at higher elevations. They do not have water continuously available during the growing season and typically have a water stress period of about 3 months. Aridisols tend to have a finer texture than the other two orders.

Entisols are found on recent landscapes, such as alluvium and disturbed sites. Soil texture tends to be more gravelly and well drained. Entisols are mineral soils that are very young and have not yet developed appreciable accumulations of soluble salts and lime. Soil horizon development is typically minimal. They occur in both the valley bottoms and higher elevations. In the mountains these tend to make up the steeper, more erodible soils, whereas at lower elevation they tend to be found in areas of deposition such as alluvial fans and floodplains. Though these sites are typically xeric, they are not as dry as the Aridisols.

Mollisols are found on dark-colored fertile surface horizons that have been formed under semiarid to sub-humid climate. Moisture availability is typically the highest in this soil type as compared to those previously mentioned. These soils are rich in organic matter and are very fertile due to the available moisture. In the project area, these soils mainly form on mountain slopes, producing healthy grass and forb communities. These soils are older and generally occur on more stable alluvial fans and terraces which have a higher degree of stability due to the increased vegetative structure.

Microbiotic crusts are a complex mosaic of cyanobacteria, green algae, lichens, mosses, microfungi, and other bacteria found throughout the Great Basin and Project Area. Cyanobacterial and microfungi filaments weave through the top few millimeters of soil, gluing loose particles together and forming a matrix that stabilizes and protects soil surfaces from erosive forces. Microbiotic crusts retain soil moisture, discourage invasion by annual species, reduce wind and water erosion, fix atmospheric nitrogen and contribute to soil organic matter. These crusts can be impacted by surface disturbing activities. With greater the disturbance, there are greater impacts and more time is required for recovery of these sites. Microbiotic crusts can also be indirectly impacted from increased erosion, whether eroded away or covered by soil from wind or water events. Slight covering by soil does not affect microbiotic crusts (Technical Reference 1730-2, 2001).

Plant Communities in the Analysis Area

Sodic Flats / Flood Plains: This community occurs on floodplains, closed-basin bottomlands adjacent to playas, and alluvial flats. Greasewood is located on slopes that range from 0-2% with an elevation of 4500-5,000 feet and occurs in precipitation zones of 3-5 and 5-8 inches. Vegetation in this type is normally restricted to mounded areas that are surrounded by playa-like depressions or nearly level, usually barren, interspaces. The soil moisture regime is aquic. This plant community is characterized by black greasewood (*Sarcobatus vermiculatus*), Basin wildrye (*Leymus cinereus*), inland saltgrass

(*Distichlis spicata*) and alkali sacaton (*Sporobolus airoides*). Saltgrass may extend into the interspace in some areas. Potential vegetative composition is typically 25% grasses, 5% forbs and 70% shrubs.

Salt Desert Shrub: This vegetative community occurs on alluvial terraces, fans and foothills on all aspects. Salt desert shrubs are located on slopes of 0-30%, with 0-8% slopes the most typical. Salt Desert Shrub occurs at elevations between 4500 and 6000 feet and within precipitation zones of 3-5 and 5-8 inches. The plant community is characterized by shadscale (*Atriplex confertifolia*), bud sagebrush (*Artemisia spinescens*) and some winterfat (*Krascheninnikovia lanata*). Bud sagebrush and winterfat are palatable salt desert shrub species. Bottlebrush squirreltail (*Elymus elymoides*) and Indian ricegrass (*Achnatherum hymenoides*) are key grass species associated with this vegetative community. Alkali meadows are included in this plant community and consist of inland saltgrass and basin wildrye. Potential vegetative composition is typically 10% grasses, 5% forbs and 85% shrubs.

Big Sagebrush: This is the most extensive community within the Analysis Area. It occurs on terraces, alluvial fans and low rolling hills on all exposures. Wyoming sagebrush (*Artemisia tridentata* ssp. *Wyomingensis*) and basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) occur on slopes of 2-50 percent with elevations ranging from 4500 to 6000 feet and within the 8-12 inch precipitation zone. This plant community is characterized by Wyoming and Basin big sagebrush, Thurber's needlegrass (*Achnatherum thurberianum*), Indian ricegrass, Basin wildrye, bottlebrush squirreltail and Sandberg's bluegrass (*Poa secunda*). Arrowleaf balsamroot (*Balsamorhiza sagittata*) and Tapertip hawksbeard (*Crepis acuminata*) are important forb species associated with this vegetation type. Potential vegetative composition is typically 50% grasses, 15% forbs and 35% shrubs.

Black Sagebrush: This vegetative community occurs on low arid foothills, mountain side slopes and plateaus. Black sagebrush (*Artemisia nova*) occurs on slopes of 4-50% with elevations ranging from 5000 to 7000 feet and is associated with the 4-8 inch precipitation zone. Soils are often shallow over a calcareous pan, which limits effective water holding capacity and seeding success. Vegetation that characterizes this community consists of black sagebrush, bottlebrush squirreltail and Sandberg's bluegrass. Bluebunch wheatgrass (*Pseudoroegneria spicata*) is characteristic for communities that occur in the higher elevations. Potential vegetative composition is typically 50% grasses, 15% forbs and 35% shrubs.

Low Sagebrush: This vegetative community occurs on mountain side slopes and plateaus. Low sagebrush occurs on slopes of 4-75% with elevations ranging from 5000 to 9000 feet and is associated with the 8-12 inch precipitation zone. Soils are often shallow over a calcareous pan, which limits effective water holding capacity and seeding success. This vegetative community is characterized by low sagebrush (*Artemisia arbuscula*), bottlebrush squirreltail, Sandberg's bluegrass and bluebunch wheatgrass. Potential vegetative composition is typically 50% grasses, 15% forbs and 35% shrubs.

Mountain Brush: This community occurs on upland terraces and inset mountain valleys on all slope aspects. Mountain brush occurs on slopes of 4-50% with elevations ranging from 6000 to 9000 feet. These communities generally occur within the 12+ inch precipitation zone. The vegetative community is characterized by Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass, snowberry (*Symphoricarpos albus*), antelope bitterbrush (*Purshia tridentata*) and serviceberry (*Amelanchier utahensis*). Mountain brome (*Bromus carinatus*), mountain spray (*Holodiscus discolor*), curl-leaf mountain mahogany (*Cercocarpus ledifolius*) and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) are other

species associated with this community. Potential vegetative composition is typically 55% grasses, 15% forbs and 30% shrubs.

Pinyon-Juniper Woodlands: This community occurs on upper alluvial fans and in the higher mountainous regions with slopes of 30-50%. Elevations range from 5500 to 9000 feet. This community occurs within the 10-22 inch precipitation zone. Lower elevation (up to 6500 feet) communities are dominated by juniper, mid elevations (6500-7500 feet) by both pinyon and juniper, and high elevations (above 7500 feet) are predominately pinyon pine. These plant communities are characterized by single-leaf pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*). There are localized ecosystems which support other juniper species such as common juniper (*Juniperus communis*) and Rocky Mountain juniper (*Juniperus scopulorum*). The understory, although sparse, consists of bluebunch wheatgrass, Sandberg's bluegrass, Thurber's needlegrass, basin wildrye and needle-and-thread grass (*Hesperostipa comata*). Juniper and pinyon trees dominate these areas; however, mountain big sagebrush, antelope bitterbrush and curl-leaf mountain mahogany can be found within the community. Heavily wooded areas provide little forage and have a large amount of bare ground. Potential vegetative composition is typically 40% grasses, 15% forbs and 45% shrubs and trees.

Riparian/Wetlands: Wetlands and small riparian communities occur within the project area and are associated with reservoirs, streams, springs and seeps where water is at or near the surface for the majority of the year. Species associated with this community include willow (*Salix* spp.), Kentucky bluegrass (*Poa pratensis*), curly dock (*Rumex crispus*), rabbit's foot grass (*Polypogon monspeliensis*), rushes (*Juncus* spp.) and sedges (*Carex* spp.). Potential vegetative composition is typically 70% grasses and grass-like species, 25% forbs and 5% shrubs.

Winterfat Bottoms: Winterfat communities generally occur in flats of drainage and flood plains. They typically occur in areas where slopes range from 0-2%. The elevation of this community ranges from 4000-6000 feet and within precipitation zones of 5-8 inches. Soils are typically sandy loam. The plant community is characterized and dominated by winterfat. It also includes vegetation such as bud sagebrush, Indian ricegrass and squirreltail. Potential vegetative composition is typically 10% grasses, 5% forbs and 85% shrubs.

Annuals: Although this vegetation type is not considered an ecological type, it is a plant community that accounts for portions of the project area. Areas that have been disturbed may be invaded by invasive annual species, sometimes to the exclusion of native species. Dominant plants are cheatgrass (*Bromus tectorum*) and/or halogeton (*Halogeton glomeratus*). Other plants often present in these areas are Russian thistle (*Salsola tragus*), clasping pepperweed (*Lepidium perfoliatum*), tumble mustard (*Sisymbrium altissimum*) and Russian knapweed (*Centaurea repens*).

Riparian Woodland Species in the Analysis Area

Cottonwoods (*Populus* spp.) are deciduous hardwood poplars belonging to the willow family. They are found naturally in riparian areas along stream banks, on the periphery of springs and ponds, and planted in agricultural areas within the lease area. These native cottonwoods rapidly grow to heights of greater than 80 feet with girths up to five feet, and are relatively short-lived (150 years). They can regenerate both from sprouting and seed. These species can also be propagated by transplanting suckers or small limbs. Currently, the Battle Mountain District protects the trees from any type of harvesting, including deadwood.

Willows (*Salix* spp.) are hardwood members of the Salicaceae family with deciduous foliage and affinities for riparian habitats with high water tables. Ranging in height from ten to 40 feet, there are more individual species of willow than any other hardwood found in the Analysis Area. Like their poplar relatives, they require relatively large, consistent amounts of water to thrive and regenerate. They are not legally harvested in the Battle Mountain District. In the Analysis Area, willows can be found in monotypic communities or associated with other riparian vegetation such as sedge, rush and poplars.

Migratory Bird Communities in the Analysis Area

Species commonly occurring in pinyon-juniper habitats and that are known to occur or have the potential to occur in the Analysis Area include the pinyon jay, western bluebird, Virginia's warbler, black-throated gray warbler and Scott's oriole. Sage thrasher, Brewer's sparrow and sage sparrow are sagebrush obligates, while loggerhead shrike and green-tailed towhee also have potential to occur in the sagebrush habitats. The Analysis Area includes riparian vegetation associated with wetlands, seeps and springs; these features are prominent in numerous proposed lease parcels. Many songbird species are heavily dependent on healthy riparian systems. Seventy-seven bird species have been identified as either riparian obligate or riparian dependent in the western United States (Rich 2002) and these communities are requisite for a diverse migratory bird community. A list of common migratory bird species known to occur in the vicinity of the project, compiled from review of various sources (Audubon, BLM, e-bird, NDOW, NHP, USFWS), includes Western meadowlark, sage sparrow, horned lark, barn swallow, mountain chickadee, Western tanager, spotted towhee, yellow warbler, Western wood peewee, killdeer, loggerhead shrike, eastern kingbird, western bluebird and common raven. The Analysis Area also includes playas, which if consistently flooded during the breeding season may provide breeding habitat for snowy plover, a BLM Nevada Sensitive species; and even if only occasionally flooded, would then provide feeding and stopover habitat for migrating shorebirds and waterfowl.

Wild Horse Habitat Management Areas (HMAs) in the Assessment Area

The Battle Mountain District administers 28 HMAs encompassing approximately 3.6 million acres of public land. Two other HMAs within the district boundary are administered by adjoining Districts. The Battle Mountain District also cooperatively manages several United States Forest Service (USFS) Wild Horse or Burro Territories (WHTs and WBTs). The estimated Battle Mountain District population as of January 1, 2018 is approximately 8,742 wild horses and 982 wild burros.

HMAs are areas identified in Resource Management Plans for long term management of wild horses or burros and are designated "Special Management Areas." Many HMAs encompass mountain ranges and include mountain browse, meadow, mahogany and pinyon and juniper vegetation types interspersed with perennial and ephemeral streams and springs. Wild horses and burros also use sparsely vegetated, rocky terrain and habitat and water sources may be limiting. Winter habitat typically consists of valley bottoms and lower elevations that support Wyoming big sagebrush, winterfat or other salt desert shrub vegetation. See the Vegetation (3.2.5) and Water (3.2.4) sections of this EA for descriptions of these resources which comprise the habitat for wild horses. No burro HMAs are included in the Analysis Area for this EA.

Wild horse and burro populations generally move throughout or between HMAs in response to a number of factors. Wild horse and burro distribution throughout HMAs varies greatly throughout the year and is influenced by forage and water availability, as well as climatic factors such as precipitation and temperature. Demographic factors such as population size and resulting animal density (competition) also

influence herd movement and distribution. Lastly, human presence causes disturbance due to OHV use, roads, mining, exploration, recreation and other uses that occur on the public lands. The Battle Mountain District has identified Core Use Areas within the HMAs which indicates where animals have been observed most consistently since inventory flights began in the 1970s and particularly within the past 20 years. These Core Use Areas can assist management in understanding what areas provide the more preferred habitat for the wild horses, as well as monitor changes in distribution or use patterns over time.

Management of wild horses involves periodic inventory activities, typically completed with helicopter, and on the ground monitoring of habitat, animal health and distribution. Wild horses foal primarily in the spring, with the peak foaling season considered March 1 through June 30. Throughout the Battle Mountain District, populations typically increase by 10-22% annually. Appropriate Management Levels (AMLs) have been established for all HMAs administered by the District. When inventory and other data indicate that the AMLs have been exceeded, gathers are planned to reduce the populations within HMAs to the AML in order to prevent deterioration of the range associated with an overpopulation of wild horses or burros. Fertility control treatments are often administered to help slow population growth rates.

Table 6. Proposed lease parcels in Herd Management Areas.

HMA	Parcel Acreage	Parcel Number	Parcel Acreage in HMA
Paymaster	1639	NV-19-09-027	All
Silver Peak	438	NV-19-09-052	All

Appendix D: Special Status Species List

All species listed here are Nevada BLM Sensitive Species as designated by the State Director, and are identified on the State Director's list as occurring in the Battle Mountain District, as of October 1 2017. Criteria set forth in the BLM 6840 Manual for designating sensitive species are:

1. Species designated as Bureau sensitive must be native species found on BLM administrated lands for which BLM has the capability to significantly affect the conservation status of the species through management, and either:
 - a. There is information that a species has recently undergone, is undergoing, or is predicted to undergo a downward trend such that the viability of the species or a distinct population segment of the species is at risk across all or a significant portion of the species range, or
 - b. The species depends on ecological refugia or specialized or unique habitats on BLM-administrated lands, and there is evidence that such areas are threatened with alteration such that the continued viability of the species in that area would be at risk.
2. All federally designated candidate species, proposed species, and delisted species in the 5 years following their delisting shall be conserved as Bureau sensitive species.

Species listed by U.S. Fish and Wildlife Service under the Endangered Species Act are identified in the first part of the table below (all are also Nevada BLM Sensitive species).

Appendix D Table 1 Battle Mountain District Endangered and Threatened Species List

Battle Mountain District <i>Endangered and Threatened</i> Species List		
Plants Common Name(4)	Scientific Name	Federal Status
Spring-loving centaury	<i>Centarium namophilum</i>	Threatened
Ash Meadows mousetails	<i>Ivesia kingii</i> var. <i>eremica</i>	Threatened
Armagosa niterwort	<i>Nitrophila mohavensis</i>	Endangered
Whitebark pine	<i>Pinus albicaulis</i>	Candidate
Bird Common Name (3)	Scientific Name	Federal Status
Western yellow-billed cuckoo	<i>Coccyzus americanus occidentalis</i>	Threatened
Southwestern willow flycatcher	<i>Empidonax trailii extimus</i>	Endangered
Ridgway's rail (Yuma clapper rail)	<i>Rallus obsoletus yumanensis</i>	Endangered
Reptile Common Name (1)	Scientific Name	Federal Status
Desert Tortoise	<i>Gopherus agassizii</i>	Threatened
Fish Common Name (2)	Scientific Name	Federal Status
Railroad Valley springfish	<i>Crenichthys nevadae</i>	Threatened
Lahontan cutthroat trout	<i>Oncorhynchus clarkii henshawi</i>	Threatened

Appendix D Table 2 Battle Mountain District Special Status Plant Species List

Battle Mountain District <i>Special Status</i> Plant Species List (32)	
Common Name	Scientific Name
Eastwood milkweed	<i>Asclepias eastwoodiana</i>
Cima milkvetch	<i>Astragalus cimae</i> var. <i>cimae</i>
Tonopah milkvetch	<i>Astragalus pseudiodanthus</i>

Battle Mountain District <i>Special Status</i> Plant Species List (32)	
Common Name	Scientific Name
Toquima milkvetch	<i>Astragalus toquimanus</i>
Currant milkvetch	<i>Astragalus uncialis</i>
Elko rockcress	<i>Boechera falcifructa</i>
Monte Neva paintbrush	<i>Castilleja salsuginosa</i>
Tecopa birdbeak	<i>Cordylanthus tecopensis</i>
Mojave (Virgin River) thistle	<i>Cirsium mohavense</i> (<i>C. virginense</i>)
Goodrich biscuitroot	<i>Cymopterus goodrichii</i>
Nevada willowherb	<i>Epilobium nevadense</i>
Windloving buckwheat	<i>Eriogonum anemophilum</i>
Beatley buckwheat	<i>Eriogonum beatleyae</i>
Deeth buckwheat	<i>Eriogonum nutans</i> var. <i>glabratum</i>
Tiehm buckwheat	<i>Eriogonum tiehmii</i>
Sand cholla	<i>Grusonia pulchella</i>
Alkali ivesia	<i>Ivesia kingii</i> var. <i>kingii</i>
Lunar Crater buckwheat	<i>Johanneshowellia crateriorum</i>
Davis peppergrass	<i>Lepidium davisii</i>
Holmgren lupine	<i>Lupinus holmgrenianus</i>
Low feverfew	<i>Parthenium ligulatum</i>
Pahute Mesa beardtongue	<i>Penstemon pahutensis</i>
Lahontan beardtongue	<i>Penstemon palmeri</i> var. <i>macranthus</i>
Bashful beardtongue	<i>Penstemon pudicus</i>
Tiehm beardtongue	<i>Penstemon tiehmii</i>
Clarke phacelia	<i>Phacelia filiae</i>
Reese River phacelia	<i>Phacelia glaberrima</i>
Williams combleaf	<i>Polycytenium williamsiae</i>
Blaine pincushion	<i>Sclerocactus blainei</i>
Nye (Tonopah) pincushion	<i>Sclerocactus nyensis</i>
Railroad Valley globemallow	<i>Sphaeralcea caespitosa</i> var. <i>williamsiae</i>
Lone Mountain goldenheads	<i>Tonestus graniticus</i>

Appendix D Table 3 Battle Mountain District Special Status Animal Species List

Battle Mountain District <i>Special Status</i> Animal Species List	
Bird Common Name (26)	Scientific Name
Northern goshawk	<i>Accipiter gentilis</i>
Golden eagle	<i>Aquila chrysaetos</i>
Short-eared owl	<i>Asio flammeus</i>
Burrowing owl	<i>Athene cunicularia</i>
Ferruginous hawk	<i>Buteo regalis</i>
Swainson's hawk	<i>Buteo swainsoni</i>
Greater sage-grouse	<i>Centrocercus urophasianus</i>
Western snowy plover (not protected Pacific Coast DPS)	<i>Charadrius nivosus nivosus</i>
Great Basin willow flycatcher	<i>Empidonax traillii odastus</i>
Peregrine falcon	<i>Falco peregrinus</i>
Sandhill crane	<i>Antigone canadensis</i>
Pinyon jay	<i>Gymnorhinus cyanocephalus</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
Least bittern	<i>Ixobrychus exilis</i>
Loggerhead shrike	<i>Lanius ludovicianus</i>
Black rosy-finch	<i>Leucosticte atrata</i>
Gray-crowned rosy-finch	<i>Leucosticte tephrocotis</i>
Lewis' woodpecker	<i>Melanerpes lewis</i>
Long-billed curlew	<i>Numenius americanus</i>
Mountain quail	<i>Oreortyx pictus</i>
Sage thrasher	<i>Oreoscoptes montanus</i>
Phainopepla	<i>Phainopepla nitens</i>
Flammulated owl	<i>Psiloscoops flammeolus</i>
Brewer's sparrow	<i>Spizella breweri</i>
Crissal thrasher	<i>Toxostoma crissale</i>
LeConte's thrasher	<i>Toxostoma lecontei</i>
Fish Common Name (9)	Scientific Name
Big Smoky Valley speckled dace	<i>Rhinichthys osculus lariversi</i>
Monitor Valley speckled dace	<i>Rhinichthys osculus ssp. 5</i>
Oasis Valley speckled dace	<i>Rhinichthys osculus ssp. 6</i>
Fish Lake Valley tui chub	<i>Siphateles bicolor ssp. 4</i>
Hot Creek Valley tui chub	<i>Siphateles bicolor ssp. 5</i>
Little Fish Lake Valley tui chub	<i>Siphateles bicolor ssp. 6</i>
Railroad Valley tui chub	<i>Siphateles bicolor ssp. 7</i>
Big Smoky Valley tui chub	<i>Siphateles bicolor ssp. 8</i>
Charnock Ranch (Charnock Springs) tui chub	<i>Siphateles bicolor ssp. 10</i>
Mammals Common Name (31)	Scientific Name
Pallid bat	<i>Antrozous pallidus</i>
Pygmy rabbit	<i>Brachylagus idahoensis</i>
Desert pocket mouse	<i>Chaetodipus penicillatus</i>
Townsend's big-eared bat	<i>Corynorhinus townsendii</i>
Big brown bat	<i>Eptesicus fuscus</i>
Spotted bat	<i>Euderma maculatum</i>
Greater western mastiff bat	<i>Eumops perotis</i>
Allen's big-eared (lappet-browed) bat	<i>Idionycteris phyllotis</i>

Battle Mountain District <i>Special Status</i> Animal Species List	
Silver-haired bat	<i>Lasionycteris noctivagans</i>
Western red bat	<i>Lasiurus blossevillei</i>
Hoary bat	<i>Lasiurus cinereus</i>
Dark kangaroo mouse (includes Desert Valley and Fletcher)	<i>Microdipodops megacephalus</i> ssp.
Pale kangaroo mouse	<i>Microdipodops pallidus</i>
Pahranagat Valley montane vole	<i>Microtus montanus fucosus</i>
California myotis	<i>Myotis californicus</i>
Western small-footed myotis	<i>Myotis ciliolabrum</i>
Long-eared myotis	<i>Myotis evotis</i>
Little brown bat	<i>Myotis lucifugus</i>
Fringed myotis	<i>Myotis thysanodes</i>
Cave myotis	<i>Myotis velifer</i>
Long-legged myotis	<i>Myotis volans</i>
Yuma myotis	<i>Myotis yumanensis</i>
Big free-tailed bat	<i>Nyctinomops macrotis</i>
Canyon bat (formerly western pipistrelle)	<i>Parastrellus hesperus</i>
Bighorn sheep	<i>Ovis canadensis</i> ssp.
Merriam's shrew	<i>Sorex merriami</i>
American water shrew	<i>Sorex pallustrus</i>
Brazilian free-tailed bat	<i>Tadarida brasiliensis</i>
Botta's pocket gopher	<i>Thomomys bottae</i>
Fish Spring pocket gopher	<i>Thomomys bottae abstrusus</i>
San Antonio pocket gopher	<i>Thomomys bottae curatus</i>
Amphibian Common Name (4)	Scientific Name
Western toad	<i>Anaxyrus boreas</i>
Amargosa toad	<i>Anaxyrus nelsoni</i>
Northern leopard frog	<i>Lithobates pipiens</i>
Columbia spotted frog	<i>Rana luteiventris</i>
Reptile Common Name (6)	Scientific Name
Great Basin collared lizard	<i>Crotaphytus bicinctores</i>
Long-nosed leopard lizard	<i>Gambelia wislizenii</i>
Pygmy short-horned lizard	<i>Phrynosoma douglassii</i>
Greater short-horned lizard	<i>Phrynosoma hernandesi</i>
Desert horned lizard	<i>Phrynosoma platyrhinos</i>
Western red-tailed skink	<i>Plestiodon [Eumeces] gilberti rubricaudatus</i>
Mollusc Common Name (9)	Scientific Name
California floater	<i>Anodonta californiensis</i>
Western ridged mussel	<i>Gonidea angulata</i>
Duckwater pyrg	<i>Pyrgulopsis aloba</i>
Southern Duckwater pyrg	<i>Pyrgulopsis anatina</i>
Large-gland Carico pyrg	<i>Pyrgulopsis basiglans</i>
Carinate Duckwater pyrg	<i>Pyrgulopsis carinata</i>
Oasis Valley pyrg	<i>Pyrgulopsis micrococcus</i>
Ovate Cain Spring pyrg	<i>Pyrgulopsis pictilis</i>
Duckwater Warm Springs pyrg	<i>Pyrgulopsis villacampae</i>

Battle Mountain District Special Status Animal Species List	
Ant, Wasp, Bee Common Name (2)	Scientific Name
Mojave gypsum bee	<i>Andrena balsamorhizae</i>
Mojave poppy bee	<i>Perdita meconis</i>
True Bug Common Name (1)	Scientific Name
Pahrnagat naucorid bug	<i>Pelocoris shoshone shoshone</i>
Beetle Common Name (4)	Scientific Name
Crescent Dunes aegialian scarab	<i>Aegialia crescenta</i>
Aegialian scarab beetle	<i>Aegialia knighti</i>
Crescent Dunes aphodius scarab	<i>Aphodius</i> ssp. 2
Crescent Dunes serican scarab	<i>Serica ammomenisco</i>
Butterfly Common Name (7)	Scientific Name
Big Smoky wood nymph	<i>Cercyonis oetus alkalorum</i>
White River wood nymph	<i>Cercyonis pegala pluvialis</i>
Monarch butterfly	<i>Danaus plexippus plexippus</i>
White Mountains skipper	<i>Hesperia miriamae longaevicola</i>
Railroad Valley skipper	<i>Hesperia uncas fulvapalla</i>
White River Valley skipper	<i>Hesperia uncas grandiosa</i>
Great Basin small blue	<i>Philotiella speciosa septentrionalis</i>

Appendix E: Hydraulic Fracturing Technology

This discussion on hydraulic fracturing is derived from the Hydraulic Fracturing (BLM 2013) written and developed by the Bureau of Land Management, Wyoming State Office. It has been modified to meet the criteria for the State of Nevada.

I. BACKGROUND

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

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

The HF process involves the injection of a fracturing fluid and propping agent into the hydrocarbon bearing formation under sufficient pressure to widen existing fractures and/or create new fractures. This allows the trapped hydrocarbons an avenue to flow to the wellbore. HF has gained interest recently as hydrocarbons trapped in low permeability or “tight” sand and shale formations are now technically and economically recoverable. As a result, geothermal production has increased significantly in the United States.

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

Generally, HF can be described as follows:

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

II. OPERATIONAL ISSUES

Wells that undergo HF may be drilled vertically, horizontally, or directionally and the resultant fractures induced by HF can be vertical, horizontal, or both. Wells in Nevada (NV) may extend to depths greater than 10,000 feet or less than 1,000 feet, and horizontal sections of a well may extend several thousand feet from the production pad on the surface. Prior to initiating HF, a cement bond log and pressure test is required and evaluated to ensure the integrity of the cement and its bond to both the well casing and the rock facies around the annulus within the geologic formation.

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

In general, approximately 25,000 to 350,000 gallons may be used to fracture shallow vertical wells in NV, while approximately 800,000 to 10 million gallons may be used to fracture deep horizontal or directionally drilled wells in NV.

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

Drilling muds, drilling fluids, water, proppant, and HF fluids are stored in onsite tanks or lined pits during the drilling and/or completion process. Equipment transport and setup can take several days, and the actual HF and flowback process can occur in a few days up to a few weeks. For oil wells, the flowback fluid from the HF operations is treated in an oil-water separator before it is stored in a lined pit or tank located on the surface. Where gas wells are flowed back using a “green completion process” fluids are run through a multi-phase separator, which are then piped directly to enclosed tanks or to a production unit. Nevada currently does not have any gas production, but this may change, if gas rich formations are discovered.

Gas emissions associated with the HF process, such as methane, carbon dioxide, and volatile organic compounds (VOCs), are captured when the operator utilizes a green completion process. A “green completion process” is where the operator captures gases at the well head immediately after the well is completed. Where a green completion process is not utilized, gas emissions associated with the well may be vented and/or flared until “saleable quality” product is obtained in accordance with federal and state rules and regulations. The total volume of emissions from the equipment used (trucks, engines) will vary based on the pressures needed to fracture the well, and the number of zones to be fractured.

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

Disposal of the waste stream following establishment of “sale-quality” product, would be handled in accordance with Onshore Order #7 regulations and other state/federal rules and regulations.

Fracturing Fluids

As indicated above, the fluid used in the HF process is approximately 95 to 99 percent water and proppants, and 1-5 percent of special-purpose chemical additives. There is a broad array of chemicals that can be used as additives in a fracture treatment including, but not limited to, hydrochloric acid, anti-bacterial agents, corrosion inhibitors, gelling agents (polymers), surfactants, and scale inhibitors. The 1 to 5 percent of chemical additives translates to a minimum of 15,000 gallons of chemicals for every 1.5 million gallons of water used to fracture a well (Paschke, Dr. Suzanne. USGS, Denver, Colorado. September 2011). Water used in the HF process is generally acquired from surface water or groundwater in the local area. Information on obtaining water and water rights is discussed below.

The Nevada Division of Minerals (NDOM) has regulations that require the reporting of the amount and type of chemicals used in a HF operation in “FracFocus” within 60 days of HF completion for public disclosure. For more information concerning FracFocus and HF, refer to the FracFocus website at www.fracfocus.org and the NDOM website at minerals.state.nv.us.

Re-Fracturing

Re-fracturing of wells (RHF) may be performed after a period of time to restore declining production rates. RHF success can be attributed to enlarging and reorienting existing fractures while restoring conductivity due to proppant degradation and fines plugging. Prior to RHF, the wellbore may be cleaned out. Cleaning out the wellbore may recover over 50% of the initial proppant sand. Once cleaned, the process of RHF is the same as the initial HF. The need for RHF cannot be predicted.

Water Availability and Consumption Estimates

According to the Nevada State Water Plan (March 1999), total statewide water withdrawals for NV are forecasted to increase about 9 percent from 4,041,000 acre-feet (af) in 1995 to 4,391,000 acre-feet in 2020, assuming current levels of conservation. Approximately one-half of these withdrawals are consumptively used. This projected increase in water use is directly attributable to Nevada’s increasing population and related increases in economic endeavors.

The anticipated rise in total statewide water withdrawals primarily reflects expected increases in public supply for municipal and industrial (M&I) water usage to meet the needs of a growing urban population, with expanding commercial and industrial activities. Nevada’s population is projected to reach about 3,047,000 by the year 2020, with about 95 percent of these residents served by public water systems (NDWP, March 1999).

M&I withdrawals currently account for about 13 percent of the water used in NV. About 77 percent of water withdrawals are currently for agricultural use. Annual M&I water use is projected to increase from 525,000 af in 1995 to 1,034,000 af in 2020 (24 percent of total water withdrawals) based upon existing water use patterns and conservation measures. Approximately 6 to 7 percent of statewide water withdrawals occur in the mining industry (NDWP, March 1999).

Interest in obtaining the necessary water supplies for wildlife and environmental needs is increasing. Additionally, the popularity of water-based outdoor recreation continues to grow. It is

anticipated that these trends will continue, resulting in increased water supply demands for wildlife, environmental and recreational purposes.

Currently, surface water supplies are virtually fully appropriated. The increase in total statewide demand, particularly M&I water use, is expected to be met via better demand management (conservation), use of alternative sources (reused water, reclaimed water and gray water), purchases, leases or other transfers from existing water users, and by new groundwater appropriations. Much of the state's unappropriated groundwater is located in basins at a distance from urban centers. Thus, increasing attention will be placed on interbasin and intercounty transfers, and implementation of underutilized water management tools such as water marketing and water banking. Water for instream flow purposes, wildlife protection, environmental purposes and recreation will likely be generated by increased conservation and the acquisition of existing water rights (NDWP, March 1999).

Comparison Figures:

- Olympic-sized swimming pool - **660,430 gallons** of water.
- Typical golf course requires **100,000 to 1,000,000 gallons** of water per week in summer to maintain healthy vegetation.
- Average car wash of fresh water uses **9 to 15 gallons** during any given wash cycle.
- Average household in Southern Nevada uses about **222 gallons** of water per day (**81,000 gallons** per year).

Potential Sources of Water for Hydraulic Fracturing

Quality freshwater is required to drill the surface-casing section of the wellbore per Federal regulations; other sections of the wellbore (intermediate and/or production strings) would be drilled with appropriate quality makeup water as necessary. This is done to protect usable water zones from contamination, to prevent mixing of zones containing different water quality/use classifications, and to minimize total freshwater volumes. With detailed geologic well logging during drilling operations, geologists/mud loggers on location identify the bottoms of these usable water zones, which aids in the proper setting of casing depths. Usable water is defined as having less than 10,000 mg/l of Total Dissolved Solids (TDS). Drinking or potable water is defined as having less than 1,000 mg/l of TDS.

Several sources of water are available for drilling and/or HF in NV. Nevada's water rights system is based on the prior appropriation doctrine; therefore, all use of water, with the exception of domestic wells, requires a permit from the State Engineer (NRS 534.180). Like any other water user, companies that drill or hydraulically fracture geothermal wells must adhere to NV water laws when obtaining and using specific sources of water.

Below is a discussion of the sources of water that could potentially be used for HF. The decision to use any specific source is dependent on BLM authorization at the GDP stage and the ability to obtain water rights. From an operators' standpoint, the decision regarding which water source will be used is primarily driven by the economics associated with procuring a specific water source.

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

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

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

Water treated at a waste water treatment plant leased or purchased from a water provider. The operator may choose to enter into an agreement with a water provider to purchase or lease water that has been used by the public and then treated as wastewater. Municipalities and other water providers discharge their treated waste water into the streams where it becomes part of the public resource, ready to be appropriated once again in the priority system. But for many municipalities a portion of the water that is discharged has the character of being "reusable." As a result, it is possible that after having been discharged to the stream, it could be diverted by the operator to be used for drilling and HF operations. Such an arrangement would only be appropriate with the approval of the Nevada Division of Water Resources, State Engineer's Office (NDWR) and would be allowed only if the water provider's water rights include uses for drilling and HF operations.

New diversion of surface water flowing in streams and rivers. New diversion of surface waters in most parts of the state are rare because the surface streams are already fully appropriated, meaning that there is no water available for appropriation. Given the variability of surface water flows in the State, this may not be the most reliable water source even if there is water available for appropriation.

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

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

On-Location Water Supply Wells. Operators may apply for, and receive, permission from the NDWR to drill and use a new water supply well. These wells are usually drilled on location to provide an on-demand supply. The proper construction, operation and maintenance, backflow prevention and security of these water supply wells are critical considerations at the time they are proposed to minimize impacts to the well and/or the waters in the well, water right holders and water-dependent resources. Plugging these wells is under the jurisdiction of the NDWR and BLM.

Authorization of any future proposed projects would require full compliance with local, state, and federal regulations and laws that relate to surface and groundwater protection and would be subject to routine inspections by the BLM and the State of Nevada Commission on Mineral Resources, Division of Minerals Memorandum of Understanding dated January 9, 2006, prior to approval.

III. Potential Impacts to Usable Water Zones

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

Should hydrocarbons or associated chemicals for geothermal development, including HF, exceeding US Environmental Protection Agency (EPA)/NDEP standards for minimum concentration levels migrate into potable water supply wells, springs, or usable water systems, it could result in these water sources becoming non-potable and killing off aquatic species. Water wells developed for geothermal drilling could also result in a drawdown in the quantity of water in nearby residential areas depending upon the geology and volumes of water extracted.

Usable groundwater aquifers are most susceptible to pollution where the aquifer is shallow (within 100 feet of the surface depending on surface geology) or perched, are very permeable, or connected directly to a surface water system, such as through floodplains and/or alluvial valleys or where operations occur in geologic zones which are highly fractured and/or lack a sealing formation between the production zone and the usable water zones. If an impact to usable waters were to occur, a greater number of people could be affected in densely populated areas versus sparsely populated areas characteristic of NV. Pollution could also impact usable waters in remote basins where interbasin transfer projects can pump and transport water through pipelines to urban areas, like Las Vegas and Reno. The BLM is also required to analyze potential impacts to aquatic species from groundwater contamination.

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

1. Contamination of aquifers through the introduction of drilling and/or completion fluids through spills or drilling problems, such as lost circulation zones.
2. Communication of the induced hydraulic fractures with existing fractures potentially allows for HF fluid migration into usable water zones/supplies. The potential for this impact is likely dependent on the local hydraulic gradients where those fluids are dissolved in the water column.
3. Cross-contamination of aquifers/formations may result when fluids from a deeper aquifer/formation migrate into a shallower aquifer/formation due to improperly cemented well casings.
4. Localized depletion of perched aquifer or drawdown of unconfined groundwater aquifer. Progressive contamination of deep confined, shallow confined, and unconfined aquifers if the deep confined aquifers are not completely cased off, and geologically isolated, from deeper oil bearing units. An example of this would be salt water intrusion resulting from sustained drawdown associated with the pumping of groundwater.
5. Casing failure (casing ruptures in low pressure formations, casing corrosion)
6. Communication through old abandoned wells nearby
7. Transportation of fluids to and from site (accidents)
8. Wastewater disposal

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

Improper casing and cementing.

A well casing design that is not set at the proper depths or a cementing program that does not properly isolate necessary formations could allow oil, gas or HF fluids to contaminate other aquifers/formations. In addition, old well casing and casing cement that has corroded over time can fail allowing contaminants to migrate into the well formation.

Natural fractures, faults, and abandoned wells.

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

Fracture growth.

A number of studies and publications report that the risk of induced fractures extending out of the target formation into an aquifer allowing hydrocarbons or other fluids to contaminate the aquifer may depend, in part, on the formation thickness separating the targeted fractured formation and the aquifer. According to a 2012 Bipartisan Policy Center report, the fracturing process itself is unlikely to directly affect freshwater aquifers because in Nevada fracturing typically takes place at a depth of 6,000 to 10,000 feet, while drinking water aquifers are typically less than 1,000 feet deep. However, some areas of Nevada, the deep carbonate aquifer can extend to 6,000 feet below ground surface. Recent studies have shown that induced fractures created during HF growing more than 350 meters vertically is less than 1% (Lacazette and Geiser). If a parcel is sold and

development is proposed in usable water zones, those operations would have to comply with federal and/or state water quality standards or receive a Class II designation from the NDEP.

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

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

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

Fluid leak and recovery (flowback) of HF fluids.

Not all fracturing fluids injected into the formation during the HF process are recovered at the surface. Estimates of the fluids recovered range from 15-80% of the volume injected depending on the site (EPA 2010). Fluid movement into smaller fractures or other geologic substructures can be to a point where flowback efforts will not recover all the fluid or that the pressure reduction caused by pumping during subsequent production operations may not be sufficient to recover all the fluid that has leaked into the formation. Fracturing fluids can remain in the formation due to adsorption and chemical reactions, movement out of the capture zone, inadequate mixing, or from fracture collapse. It is noted that the fluid loss due to leakage into small fractures and pores is minimized by the use of cross-linked gels.

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

The ability of HF chemicals to migrate in an undissolved or dissolved phase into a usable water zone is likely dependent upon the location of the sealing formation (if any), the geology of the sealing formation, hydraulic gradients and production pressures.

HF fluids can remain in the subsurface unrecovered, due to “leak off” into connected fractures and the pores of rocks. Fracturing fluids injected into the primary hydraulically induced fracture can intersect and flow (leak off) into preexisting smaller natural fractures. Some of the fluids lost in

this way may occur very close to the well bore after traveling minimal distances in the hydraulically induced fracture before being diverted into other fractures and pores. Once “mixed” with the native water, local and regional vertical and horizontal gradients may influence where and if these fluids will come in contact with usable water zones, assuming that there is inadequate recovery either through the initial flowback or over the productive life of the well. Faults, folds, joints, etc., could also alter localized flow patterns as discussed below.

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

Check-Valve Effect

A check-valve effect occurs when natural and/or newly created fractures open and HF fluid is forced into the fractures when fracturing pressures are high, but the fluids are subsequently prevented from flowing back toward the wellbore as the fractures close when the fracturing pressure is decreased (Warpinski et al., 1988; Palmer et al., 1991a).

A long fracture can be pinched-off at some distance from the wellbore. This reduces the effective fracture length. HF fluids trapped beyond the “pinch point” are unlikely to be recovered during flowback and oil/gas is unlikely to be recovered during production.

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

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

Adsorption and Chemical Reactions

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

Movement of Fluids outside the Capture Zone

Fracturing fluids injected into the target zone flow into fractures under very high pressure. The hydraulic gradients driving fluid flow away from the wellbore during injection are much greater than the hydraulic gradients pulling fluid flow back toward the wellbore during flowback and production (pumping) of the well. Some portion of the fracturing fluids could be forced along the hydraulically induced fracture to a point beyond the capture zone of the production well. The size

of the capture zone will be affected by the regional groundwater gradients, and by the drawdown caused by producing the well. Site-specific geologic and hydrogeologic characteristics, injection pressure, and production pumping details should provide the information needed to estimate the dimension of the production well capture zone and the extent to which the fracturing fluids might disperse and dilute.

Incomplete Mixing of Fracturing Fluids with Water

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

IV. Geologic Hazards (including seismic/landslides)

Nevada is the 3rd most tectonically active state in the union. Since the 1850s there have been 63 earthquakes with a magnitude greater than 5.5, the cutoff for a destructive earthquake. Potential geologic hazards caused by HF include induced seismic activity in addition to the tectonic activity already occurring in the state. Induced seismic activity could indirectly cause a surficial landslide where soils/slopes are susceptible to failure. Landslides involve the mass movement of earth materials down slopes and can include debris flows, soil creep, and slumping of large blocks of material. Any destructive earthquake also has the potential to induce liquefaction in saturated soils.

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

A study conducted by the National Academy of Sciences (Induced Seismicity Potential in Energy Technologies, National Academy of Sciences, 2012) studied the issue of induced seismic activity from energy development. As a result of the study, they found that:

1. The process of hydraulic fracturing a well as presently implemented for shale gas recovery does not pose a high risk for inducing felt seismic events; and
2. Injection for disposal of waste water derived from energy technologies into the subsurface does pose some risk for induced seismicity, but very few events have been documented over the past several decades relative to the large number of disposal wells in operation.

However, a more recent study by the U.S. Geological Service has found that at some locations the increase in seismicity coincides with the injection of wastewater in deep disposal wells. Wastewater injection increases the underground pore pressure, which may, in effect, lubricate nearby faults thereby weakening them. If the pore pressure increases enough, the weakened fault will slip, releasing stored tectonic stress in the form of an earthquake. Even faults that have not moved in millions of years can be made to slip and cause an earthquake if conditions underground are appropriate (USGS 2014).

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

V. Spill Response and Reporting

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

In addition to EPA’s requirements, operators must provide a plan for managing waste materials, and for the safe containment of hazardous materials, per Onshore Order #1 with their GDP proposal. All spills and/or undesirable events are managed in accordance with Notice to Lessee (NTL) 3-A for responding to all spills and/or undesirable events related to HF operations.

Certain geothermal exploration and production wastes occurring at or near wellheads are exempt from the Clean Water Act, such as: drilling fluids, produced water, drill cuttings, well completion, and treatment and stimulations fluids. In general, the exempt status of exploration and production waste depends on how the material was used or generated as waste, not necessarily whether the material is hazardous or toxic.

VI. Public Health and Safety

The intensity, and likelihood, of potential impacts to public health and safety, and to the quality of usable water aquifers is directly related to proximity of the proposed action to domestic and/or community water supplies (wells, reservoirs, lakes, rivers, etc.) and/or agricultural developments. The potential impacts are also dependent on the extent of the production well’s capture zone and well integrity. Nevada’s Standard Lease Stipulations and Lease Notices specify that geothermal development is generally restricted within 500 feet of riparian habitats and wetlands, perennial

water sources (rivers, springs, water wells, etc.) and/or floodplains. Intensity of impact is likely dependent on the density of development.

VII. Hydraulic Frac Job Data for Nevada

Operator	Noble Energy	Noble Energy	Noble Energy	Makoil	Grant Canyon
Well	Humboldt M2C-M2-21	Huntington K1L-1V	Humboldt M10C-M10-11	Portugese Mountain 14A	Blackburn #16
Total Base Water Volume (gal)	250,057	300,537	343,919	29,949	209,600
2% KCL Water	88.5614	0	86.45119	0	0
Fresh Water	0	88.9968	0	53.90215	85.2039
Water	1.57645	0.61826	0.81892	0.78169	0.53354
2-bromo-2-nitro-1, 3-propanediol	0.00202	0.00213	0.00358	0.00129	0.00171
Crystalline Silica, quartz	0.65036	8.59936	10.49356	32.39228	14.4277
Ethylene glycol monobutyl ether	0.02379	0.00537	0.01688	0.09718	0.02695
Isopropanol	0.00311	0.00351	0.00221	0.04926	0.00353
Methanol	0.00311	0.00353	0.00226	0.05782	0.00361

* Values are based on the percent of the total mass. These are the most common additives in all the jobs.

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Appendix F: Definitions, Acronyms and Abbreviations

Definitions

Invasive plant: a plant that is not part of (if exotic) or a minor component of (if native) the original plant community or communities, and has the potential to become a dominate or co-dominate species on the site if future establishment and growth are not actively controlled by management interventions; or a plant that is classified as exotic or noxious under state or federal law. Species that become dominant for only one to several years (e.g. short-term response to drought or wildfire) are not invasive plants.

Noxious weed: a plant designated by federal or state laws as generally possessing one of more of the following characteristics: aggressive and difficult to manage; parasitic; a carrier or host of serious insect of disease; or nonnative, new or not common to the U.S. The BLM Battle Mountain District recognizes the current noxious weed list designated by the State of Nevada Department of Agriculture (NDA) statute, found in Nevada Administrative Code (NAC) 555.010.

Weed: any plant that interferes with management objectives for a given area of land at a given point in time.

Acronyms and Abbreviations

AFY	acre-feet per year
AQRV	air quality related values
ARMPA	Approved Resource Management Plan Amendment
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BMDO	Battle Mountain District Office
BMPs	Best Management Practices
CESA	Cumulative Effects Study Area
CFR	Code of Federal Regulations
COAs	Conditions of Approval
CSU	Controlled Surface Use
DOI	United States Department of the Interior
EA	Environmental Assessment
EO	Executive Order
ESA	Endangered Species Act

EPA	Environmental Protection Agency
FLPMA	Federal Land Policy and Management Act of 1976
GDP	Geothermal Drilling Permit
GHG	greenhouse gas
GHMA	General Habitat Management Area
GIS	Geographic Information System
GRSG	Greater Sage-Grouse
GRSG Plan Amendment	2015 Nevada and Northeastern California Greater Sage-Grouse Approved Resource Management Plan Amendment
GWP	Global Warming Potential
HAPs	hazardous air pollutants
HF	hydraulic fracturing
HMA	Herd Management Area
ID Team	interdisciplinary team
IM	Instruction Memorandum
LLD	legal land description (township, range, section)
MD	Management Decision
MLFO	Mt. Lewis Field Office
MOU	Memorandum of Understanding
MR	Mineral Resources
NAAQS	National Ambient Air Quality Standards
NAC	Nevada Administrative Code
NDOW	Nevada Department of Wildlife
NEPA	National Environmental Policy Act
NDA	Nevada Department of Agriculture
NDEP	Nevada Division of Environmental Protection
NDWR	Nevada Division of Water Resources

NDWQ	Nevada Division of Water Quality
NHPA	National Historic Preservation Act
NNHP	Nevada Natural Heritage Program
NSO	No Surface Occupancy
NSE	Nevada State Engineer for Division of Water Resources
NVSO	Nevada State Office
OHMA	Other Habitat Management Area
PHMA	Priority Habitat Management Area
PL	Public Law
RFD	reasonably foreseeable development
RFFA	reasonably foreseeable future action
RMP	Resource Management Plan
ROD	Record of Decision
ROW	Right-of-Way
SETT	Sagebrush Ecosystem Technical Team
SFA	Sagebrush Focal Area
SHPO	Nevada State Historical Preservation Office
SSS	Special Status Species
TFO	Tonopah Field Office
TL	Timing Limitation
tpy	tons per year
U.S.	United States
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
VRM	Visual Resource Management

Appendix G: Geothermal Resource Exploration and Development

Anytime during the 10-year term of a geothermal lease, the lessee, or operator, would submit specific plans for geothermal exploration and development to BLM for approval. These plans would be in the form of a Notice of Intent to explore, Geothermal Drilling Permit (GDP), or Plan of Development (POD). BLM then reviews the submission to determine if there are any other site-specific conditions of approval that should be applied. Such conditions of approval must be consistent with the lease rights granted. In conjunction with obtaining approval to explore or develop a leased parcel, the operator would also seek a right-of-way to access the leased lands.

This following section provides a general description of possible post-leasing activities, based on the *Geothermal Leasing in the Western United States Programmatic Environmental Impact Statement, 2008*.

Geophysical Exploration Surveys: Geophysical exploration can be performed on the surface of the land. Typically geophysical surveys involve collecting electrical, magnetic, chemical, seismic, and rock data. Surveys may be done using four-wheel drive vehicles, helicopters, or on foot. Seismic surveys are performed over large areas using an array of data collectors (geophones) while a pulse of seismic energy is released via small charges below the ground surface or by a vibroseis truck. Disturbance is limited to overland travel and small, (less than three square feet) of disturbance. The surveys take several days to complete and occasionally are left in place to collect natural earthquake data over a longer period of time. Resistivity surveys are performed using long cables over a smaller area (100 feet) on the land surface. The cables are moved and set up along a grid lines repeatedly. This survey involves minor, temporary disturbances (tens of square feet). In summary geophysical surveys involve short duration, small land disturbance.

Geothermal Exploration Drilling: Temperature gradient (TG) wells are used to measure thermal increase with depth. Drilling is usually done with a truck-mounted rotary or diamond-core drill and depths between 500 and 2,000 feet. Geologists look at the rock fragments or core from the subsurface, along with groundwater to determine the characteristics of the strata and presence of underground geothermal reservoirs. The borehole is cemented with downhole casing or tubing and filled with water. Later, temperature measurement equipment is used to assess thermal gradient. Typical exploration drilling requires minimal work area, often less than one acre of disturbance. Drill rigs require access roads and while existing roads may be used, an assumption of one to six acres of disturbance for new roads is estimated. Access and use of a drill site may involve land clearing, up to 0.1 acres per site. The drill rig may be up to 60 feet tall. A generator, tanker truck, and support vehicles are present during drilling. When completed, the TG well will have a small diameter well cellar (about three feet) surrounding a conductor casing. Drilling may take several weeks.

Drilling fluids are often used to lubricate the bit and to aid in cuttings removal. Fuel, coolant, and lubricants are needed for the drill and support equipment, drilling additives and water are used during drilling, and cement and water are needed to complete the well, all are expected to be present at any time during drilling. The risk of spills of other fluids are reduced through best management practices identified in the drill plan. If a well is not successful, the well is plugged and abandoned according to State regulations, and the surface disturbance is reclaimed. If a well is successfully drilled, the surface disturbance is usually reclaimed within one year and the well continues to be used for measuring

temperature gradient for a period of time while additional exploration takes place. Reclamation includes removing all surface equipment and structures, grading the site to pre-disturbance contours, and replanting native or appropriate vegetation to facilitate natural restoration.

Geothermal Resource Testing: Once exploration identifies the presence of a geothermal resource, additional exploration wells are drilled to test the geothermal resource. Drilling operations involve producing geothermal fluids for chemical analysis and flow testing, as well as using the well to inject fluids back into the geothermal reservoir. Larger equipment is needed along with a larger well pad. Wells are typically deeper, with larger diameter holes and blow out prevention (BOP) equipment is used to protect people and drilling equipment from accidental release of geothermal fluids. There are usually 10 to 15 people on-site at all times, and more people and vehicles coming and going with equipment and supplies.

If a reservoir is discovered and sufficient for development, a wellhead, with valves and control equipment, would be installed on top of the well casing. Excess geothermal fluids are stored in temporary pits or sumps, generally lined with plastic (small sumps) or clay (large sumps). The water is left to evaporate and any sludge is removed and properly disposed. A geothermal well may be left in place for a longer period of time during the resource utilization planning stage and up to five acres per well pad may be expected. In addition, roads will add additional disturbance, usually between 5 and 32 acres.

If the well is not successful, the well is plugged and abandoned according to State regulations, and the surface disturbance is reclaimed as described above.

Geothermal Reservoir Development and Utilization: Once the geothermal reservoir is identified, additional wells are drilled for use as production or injection wells, along with well pads, access roads, pipelines, transmission lines, and the power generation facility. The utilization plan is dependent upon the quality of the geothermal reservoir. Geothermal resources are classified as low temperature (less than 90°C, or 194°F), moderate temperature (90°C to 150°C, 194°F to 400°F), and high temperature (greater than 150°C, 302°F). Three types of power plants that harness geothermal resources are dry steam plants, flash steam plants, and binary-cycle plants but binary-cycle power plants are most common in Nevada. Binary-cycle power plants use water from the geothermal reservoir to heat another “working fluid.” The working fluid is vaporized and used to turn the turbine/generator units. The geothermal water and the working fluid never come in contact with each other. Binary-cycle power plants can operate with lower water temperature 74°C to 182°C, (165°F to 360°F) and produce few air emissions (PEIS, 2008).

The number of personnel required during construction varies significantly, but at any one point there may be a few hundred laborers and professionals on-site with associated vehicles. The number of people required for routine operation of a power plant is dependent on the plant size, but typically involves nine to fifteen people per shift, and more during the day for maintenance and management. A 50 MW geothermal power plant would be expected to disturb between 53 and 367 acres (including roads, well pads, pipelines, power plant and electrical transmission lines.)

REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

A Reasonably Foreseeable Development (RFD) Scenario has been prepared to support analyses related to the review of parcels in the Battle Mountain District that have been nominated for a statewide competitive geothermal lease sale in September 2019. The Reasonably Foreseeable Development (RFD) scenario is taken from the *Proposed Tonopah Resource Management Plan and Final Environmental Impact Statement, 1994* (FEIS) and is applied to the entire Battle Mountain District.

Currently there are 33 authorized leases in the Battle Mountain District, 13 in Mount Lewis Field Office and 20 in Tonopah Field Office. These leases total 91,797 acres. Future development of geothermal resources in the Battle Mountain District is expected to be used in the following ways:

- A. Small electric generating facilities, such as the Jersey Valley or Beowawe power plants
- B. Expansion of existing power plant(s), such as McGinness Hills
- C. Direct use, such as heap leaching with geothermal fluids at Round Mountain Gold
- D. Indirect use, such as greenhouse heating, dehydration plants, and home heat

The FEIS for TFO predicted the development of two, 15 MW geothermal power plants which would be developed in conjunction with or after 60-80 thermal gradient holes were drilled (no disturbance), using 7 production wells, access roads, and drill sites (40 acres), and power line roads (75 acres). The RFD scenario also predicted that Round Mountain gold operations would need additional wells for development and heap leach activities associated with gold recovery through the addition of 4 production and 4 injection wells (7 acres disturbance). The FEIS anticipated indirect uses for dehydration plants (2 production and 2 injection wells, 71 acres) and two greenhouses (142 acres), and domestic uses (7.5 acres).

Battle Mountain District has permitted geothermal exploration projects, primarily seismic surveys, resistivity surveys, and exploration (thermal gradient) (TG) well drilling. Geothermal exploration has occurred in Alum, Fish Lake, Clayton, Hot Creek, Smoky, Buffalo, Grass, and Reese River Valleys and McGinness Hills. In comparison to the predictions made in the FEIS for TFO, which is being applied to the entire Battle Mountain District, approximately 122 thermal gradient, production, and injection wells were drilled, and four power plants (McGinness Hills and Beowawe) have been developed.

GEOHERMAL EXPLORATION

Exploration at Alum, T. 1. N., R. 38 ½ E., M.D.M. resulted in two production-sized wells, with 3.81 acres of disturbance, and less than one mile of access road (0.71 acres), for a total of 2.26 acres/well. This project is proposed for power generation in the next few years.

Exploration in Whirlwind Valley, near Beowawe, T. 31 N., R. 47-48 E., M.D.M., resulted in 4 production wells on private land, and two injection wells on public land, three miles of access roads, resulting in approximately 24.7 acres of total disturbance, primarily on private land or 4.5 acres/well disturbance.

Exploration drilling in Buffalo Valley (T. 29 N., R. 41 E., M.D.M.), resulted in 12 TG wells drilled and 5.8 acres of surface disturbance and 1.3 miles of roads (0.94 acres) for a total of 0.56 acres/well of disturbance.

Fish Lake Valley, Nevada, in T. 1 S., R. 35 E., M.D.M., was drilled in the mid-1980s. A total of 12 production and thermal gradient wells were drilled but utilization was never achieved, in part, due to the high cost of transmission, this project resulted in 16.4 acres disturbance and 6.7 miles of access roads (4.9 acres), for approximately 1.8 acres/well.

In Clayton Valley, T. 2. S., R. 39-40 E., M.D.M. magnetotelluric, resistivity, and seismic geophysical surveys were used to identify a geothermal feature, a total of 10 TG wells were drilled, two large-diameter; however, exploration drilling did not identify a quantifiable resource. Because disturbance areas were co-located on mining areas, disturbance figures are skewed and therefore, not used for this scenario.

In Reese River Valley, T. 23-24 N., R. 43 E., M.D.M, 15 TG wells were drilled with 8.7 acres of surface disturbance and approximately 3.7 miles of roads were used (2.69 acres) or approximately 0.76 acres/well.

In northern Grass Valley, T. 24 N., R. 47 E., M.D.M., two temperature gradient wells were drilled (5.72 acres) and just over 3 miles of roads used (2.18 acres) or approximately 3.95 acres/well of disturbance.

Exploration at McGinness Hills, T. 20 N., R. 45 E., M.D.M., resulted in 27 exploration, production, and injection wells drilled on public and private land, with 146 acres of surface disturbance, or 5.8 acres/well. McGinness Hills is a world-class facility, with two to four wells per well pad and injection wells located on private land.

Given the exploration in the BMD, it is reasonably foreseeable that continued interest in geothermal projects could result in the predicted 60 to 80 temperature gradient wells over the next 20 years. The estimated disturbance associated with those wells, based on historical exploration averages is 2.5 acres/well or 150 to 200 acres of disturbance associated with exploration. The table below is taken from the PEIS and modified for the BMD.

Table 7 Typical Disturbance for Geothermal Resource Exploration

Exploration Phase	Disturbance Estimate per Plant
Geophysical surveys	30 square feet ¹
Gravity and magnetic surveys	negligible
Seismic surveys	Negligible
Resistivity surveys	Negligible
Temperature gradient wells, roads	0.5-2.5 acres ²
Total (60-80 wells)	150-200 acres

¹ Calculated assuming 10 soil gas samples, at a disturbance of less than three square feet each.

² Calculated are as compared to actual disturbance in BMD. Estimate is a representative average disturbance of all well sites. Some wells may require a small footprint (e.g., 30 x 30 feet), while others may require larger rigs and pads (e.g., 150 x 150 feet).

Small electric generating facilities could be constructed in Clayton, Fish Lake, Hot Creek, Smoky, Jersey, Buffalo, Grass, and Reese River Valleys. These areas have localized elevated geothermal resources. Given the numerous geothermal exploration projects over the past thirty years, it is possible that at least two small electric generating facilities would be developed in the next ten years in BMD.

GEOHERMAL DEVELOPMENT

Two examples of small, geothermal electric generating facilities are chosen for the development scenario, Beowawe and Jersey Valley. The Jersey Valley power plant, located in Winnemucca District T., 27 N., R. 40 E., M.D.M., was developed to be 22 MW in size and consists of three production wells, five injection wells, twenty-eight miles of transmission line and four miles of road. This facility has approximately 32 acres of surface disturbance, 12 acres are associated with the power generation facility.

Beowawe power plant, in Whirlwind Valley, T. 31 N., R. 47-48 E., M. D. M. was developed in the mid to late 1980s and utilizes four production wells, two injection wells, 3 miles of transmission line, and approximately two miles of roads and pipelines, and a small, 16.6 MW power plant. This facility has approximately 25 acres of surface disturbance. If two facilities are constructed in BMD in the next ten years, each facility could require 5 to 10 production wells and 5 to 10 injection wells. The table below is taken from the PEIS and modified for the BMD.

Appendix G Table 1 Typical Disturbance for Geothermal Resource Development

Development Drill and Utilization Phase	Disturbance Estimate per Plant
Drilling and well field development	2.5 – 50 acres ¹
Road improvement/construction	4.5 – 75 acres ²
Power plant construction	5 – 40 acres ³
Installing wellfield equipment including pipelines	6 – 60 ⁴
Installing transmission lines	15 – 145 ⁵
Well workovers, repairs and maintenance	Negligible
Total (2 - 15 MW facilities)	33-370 acres

¹ Size of the well pad varies greatly based on the site-specific conditions. Based on BMD inspections, well pads range from 0.5 to 4.5 acres. Using the Jersey valley and Beowawe examples, a 15 MW power plant requires about ten well pads to support five to 10 production wells and five to 10 injection wells. Multiple wells may be located on a single well pad.

² One-quarter to two miles per well, five to ten wells. Estimates 30-foot wide surface disturbance for a 18-20 foot road surface, including cut and fill slopes and ditches.

³ Expect disturbance co-location with production or injection wells, 5 acres to 20 acres of disturbance for 15-20 MW plant.

⁴ Pipelines between well pad to plant assumed to be 2-4 miles with a 25-foot-wide corridor.

⁵ Three to 30 miles long, 20-foot-wide corridor.

⁶ Disturbance would be limited to previously disturbed areas around the well(s).

An example of a large power plant is the McGinness Hills facility, located in southern Grass Valley, T. 20 N., R. 45 E., M.D. M. The power plant is located on public land and consists of two 37 MW and one 50 MW power plant, 15 production wells, eight injection wells, nine miles of transmission line, and 2 miles of roads. It is reasonable to assume this facility may be expanded to produce additional power. The total disturbance approximates 146 acres. This facility represents an atypical geothermal resource that is extremely well suited to production and injection because of the geology. It is not indicative of other sites within BMD.

Drilling projects will continue to fluctuate, as seen in the past forty years since the Shosone-Eureka and Tonopah Resource Management Plans were written. Projects on the horizon include one small power plant near Alum in lower Smoky Valley and expansion of the McGinness Hills facility. Each new discovery would foster an increase in drilling activity which would last for two to three years.

For the purposes of this analysis, the following assumptions are made for lease and production operations:

A total of 60 to 80 exploration wells (temperature gradient and small production test wells) would be drilled in the next twenty years. These wells would identify two small geothermal fields. Each exploration well site and access roads would result in an average of 2.5 acres of surface disturbance or up to 200 acres of surface disturbance associated with exploration.

Each power producing plant would require between five and to ten wells to supply geothermal fluids for a binary power plant and between five and ten wells would be used to re-inject the spent water to the reservoir. Wells would be co-located where possible, up to two wells per well pad with the average pad disturbance of 2.5 acres per pad or up to 50 acres total. Production and injection wells for two power plants would utilize exploration roads but an additional 75 acres of roads may be required.

Wells would not exceed 10,000 feet in depth and temperatures would be expected in the 'moderate' range, therefore binary-cycle power plants would be expected to be used. Both power plants would be between five and twenty acres in size, or up to 40 acres total.

Wells would pump geothermal fluids to the power facility between two and four miles away, with pipelines aggregated in a 25-foot wide corridor, for up to 60 acres of disturbance. Transmission lines are expected to be between three and thirty miles in length with a 20-foot wide corridor, up to 145 acres of disturbance.

In summary, geothermal exploration and production activities could result in a maximum of 570 acres of disturbance in the next twenty years. In comparison to the Battle Mountain District of 10.45 million acres of land under management, this figure represents less than 0.01 percent.

Appendix H: Proposed lease parcels intersecting inventory units that have wilderness characteristics

Inventory units in the Analysis Area that have wilderness characteristics are listed here, along with the proposed lease parcels that intersect each of those units. Also see Appendix K, Figure22.

Parcel #	Wilderness Characteristics Inventory Unit
26	NV-060-0364 A
27	NV-060-0320
52	NV-060-323 NV-060-328

Appendix I: Land Use Authorizations Table

Parcel #	Legal Lands Description	ROW Case File/ROW Holder Range Improvement Description
NV-19-09-027	T.0010S, R.0400E, 21 MDM, NV Sec. 024 ALL;	N-92355 Esmeralda County, Road N-065524 Transmission line
NV-19-09-052	T.0010N, R.0360E, 21 MDM, NV Sec. 036 PROT ALL; T.0010N, R.0370E, 21 MDM, NV Sec. 031 PROT ALL; 032 PROT ALL; T.0010S, R.0370E, 21 MDM, NV Sec. 006 PROT ALL;	N74099 Geo-energy partners, expired geothermal Lease N-54394 RS2477 N-54402 RS2477
NV-19-09-132	T.0310N, R.0470E, 21 MDM, NV Sec. 010 E2; 012 ALL;	N-65084 Esmeralda County, Road N-56088 Sierra Pacific Power Co., dBA NV Energy, transmission line
NV-19-09-136	T.0310N, R.0470E, 21 MDM, NV Sec. 002 LOTS 5-44; 002 S2NE, S2NW, S2;	N-60093 Santa Fe Pacific, Water Pipeline
NV-19-09-137	T.0300N, R.0480E, 21 MDM, NV Sec. 006 LOTS 1-3; T.0310N, R.0480E, 21 MDM, NV Sec. 006 LOTS 1-7; 006 S2NE, SENW, E2SW, SE; 030 LOTS 1-4; 030 E2, E2NW, E2SW;	N-85132 Ludwig-Maximilians University Munich, Test Pits N-60250 Newmont Mining Corp., Wells, water pipeline, booster pump, road N-59670 Sierra Pacific Power Co., dBA NV Energy, transmission line

Appendix J: Environmental Justice Analysis

Battle Mountain District September 2019 Geothermal Lease Sale Environmental Justice Analysis

Julie A Suhr Pierce, PhD
Great Basin Socioeconomic Specialist

A low income Environmental Justice (EJ) population is present. The percentage of the population classified as low income in three of the blockgroups¹ analyzed is more than 10 percentage points than that of the State of Nevada (the reference population). A low income EJ population, therefore is present for the purposes of this analysis.

A minority EJ population is not present. The percentage of the population identified as belonging to a minority group in each of the blockgroups analyzed is not equal to or greater than 50 percent, nor is it more than 10 percentage points higher than that of the State of Nevada. A minority EJ population, therefore, is not present for the purpose of this analysis.

Appendix J Table 1 Lease Sale Parcel Demographics

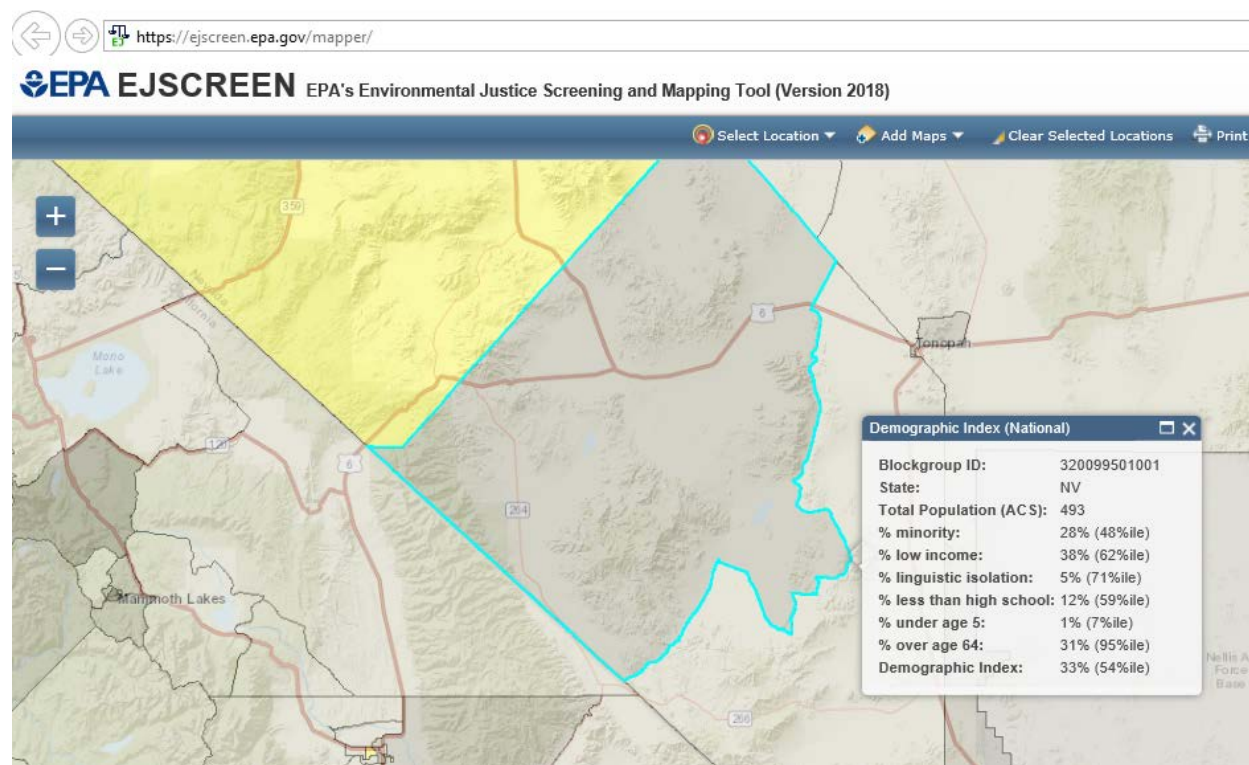
Population	Low Income	Minority
Blockgroup 320099501001	38%	28%
Blockgroup 320239601001	32%	15%
Blockgroup 3201550003002	36%	27%
State of Nevada (reference population)	14.2%	49.5%

Data sources:

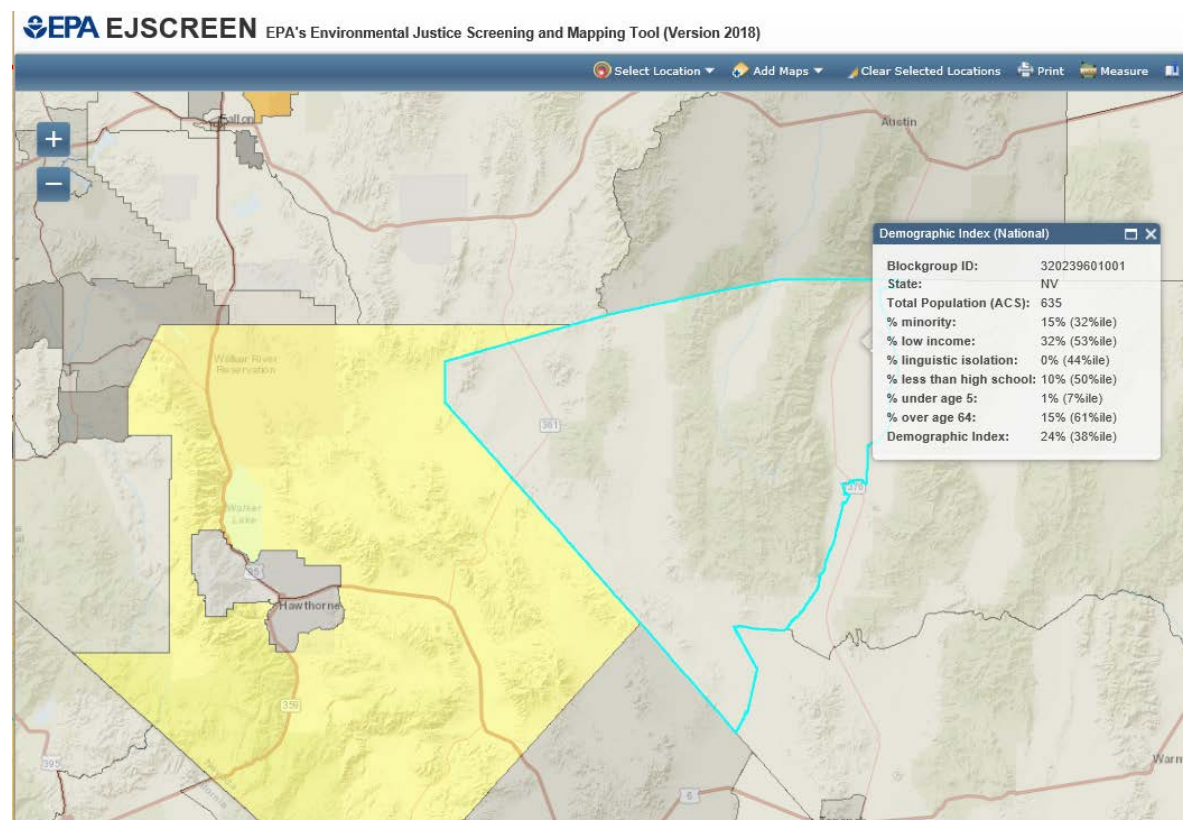
- EPA EJScreen: <http://www.epa.gov/ejscreen> (accessed June 18, 2019)
- Headwaters Economics EPS: <https://headwaterseconomics.org/tools/economic-profile-system/#measures-report-section> (accessed June 18, 2019)

¹ A block group is an area defined by the U.S. Census Bureau that usually has 600-3000 people living in it. The U.S. is divided into more than 200,000 block groups

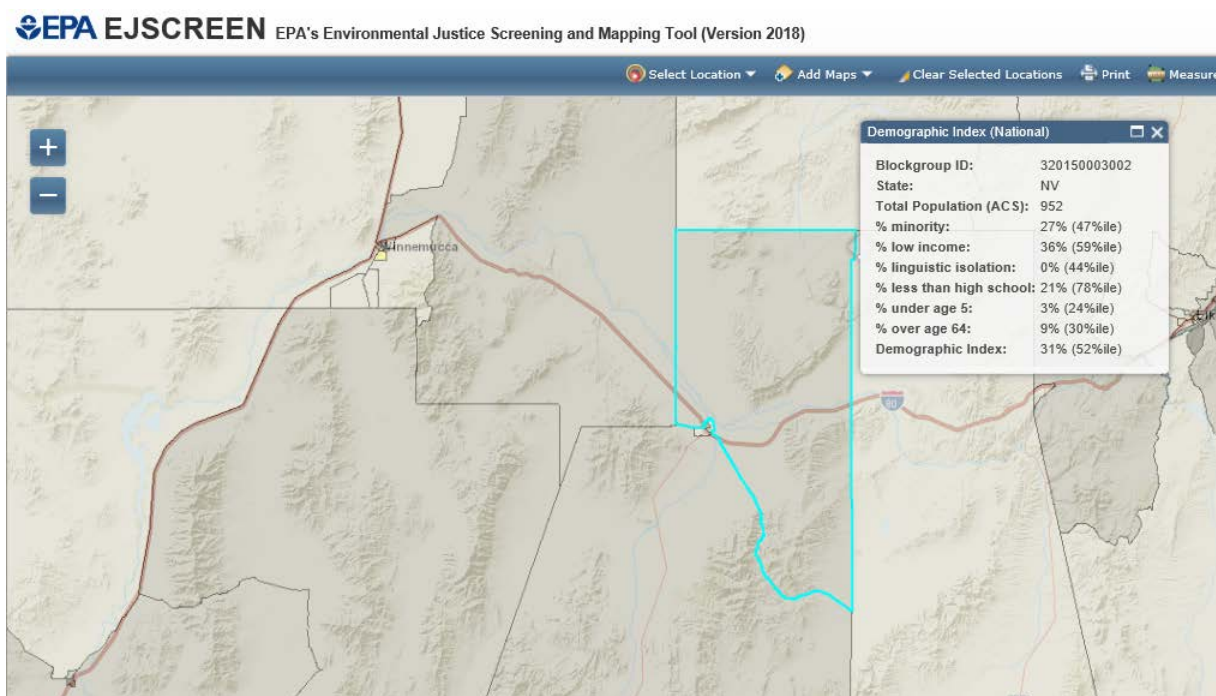
Parcels 27 and 52 (Blockgroup 320099501001)



Parcel 26 (Blockgroup 320239601001)



Parcels 132, 133, 135, 136, 137, 140 (Blockgroup 3201550003002)



Appendix K: Maps of Proposed Lease Parcels and Associated Resources

For ease of reference, this appendix contains all maps showing proposed lease parcels together with various associated resources as described in the EA. See the project's National NEPA Register website for higher resolution maps.

Figures in Chapter 1 of the EA:

1. Proposed lease parcels in Mount Lewis and Tonopah Field Offices, Battle Mountain District.
2. Proposed lease parcels in Mount Lewis Field Office.
3. Proposed lease parcels in Tonopah Field Office.

Figures in this appendix:

Mount Lewis Field Office

4. Land status and proposed lease parcels in Battle Mountain District.
5. Land status and proposed lease parcels in Mount Lewis Field Office.
6. Water resources and proposed lease parcels in Mount Lewis Field Office.
7. Pronghorn seasonal habitat and proposed lease sale parcels in Mount Lewis Field Office.
8. Mule deer seasonal habitats and proposed lease parcels in Mount Lewis Field Office.
9. Greater Sage-Grouse habitats and proposed lease parcels in Mount Lewis Field Office.
10. Grazing allotments and proposed lease parcels in Mount Lewis Field Office.
11. Visual Resource Inventory and proposed lease parcels in Mount Lewis Field Office.

Tonopah Field Office

12. Land status and proposed lease parcels in Tonopah Field Office.
13. Water resources and proposed lease parcels in Tonopah Field Office.
14. Pronghorn seasonal habitat and proposed lease sale parcels in Tonopah Field Office.
15. Mule deer movement corridors and proposed lease parcels in Tonopah Field Office.
16. Mule deer habitat and proposed lease parcels in Tonopah Field Office.
17. Bighorn sheep habitat and proposed lease parcels in Tonopah Field Office.
18. Bighorn sheep winter habitat and proposed lease parcels in Tonopah Field Office.
19. Wild horse and burro Herd Management Areas and proposed lease parcels in Tonopah Field Office.
20. Grazing allotments and proposed lease parcels in Tonopah Field Office.
21. Visual Resource Management and proposed lease parcels in Tonopah Field Office.
22. Wilderness characteristics inventory units and proposed lease parcels in Tonopah Field Office.

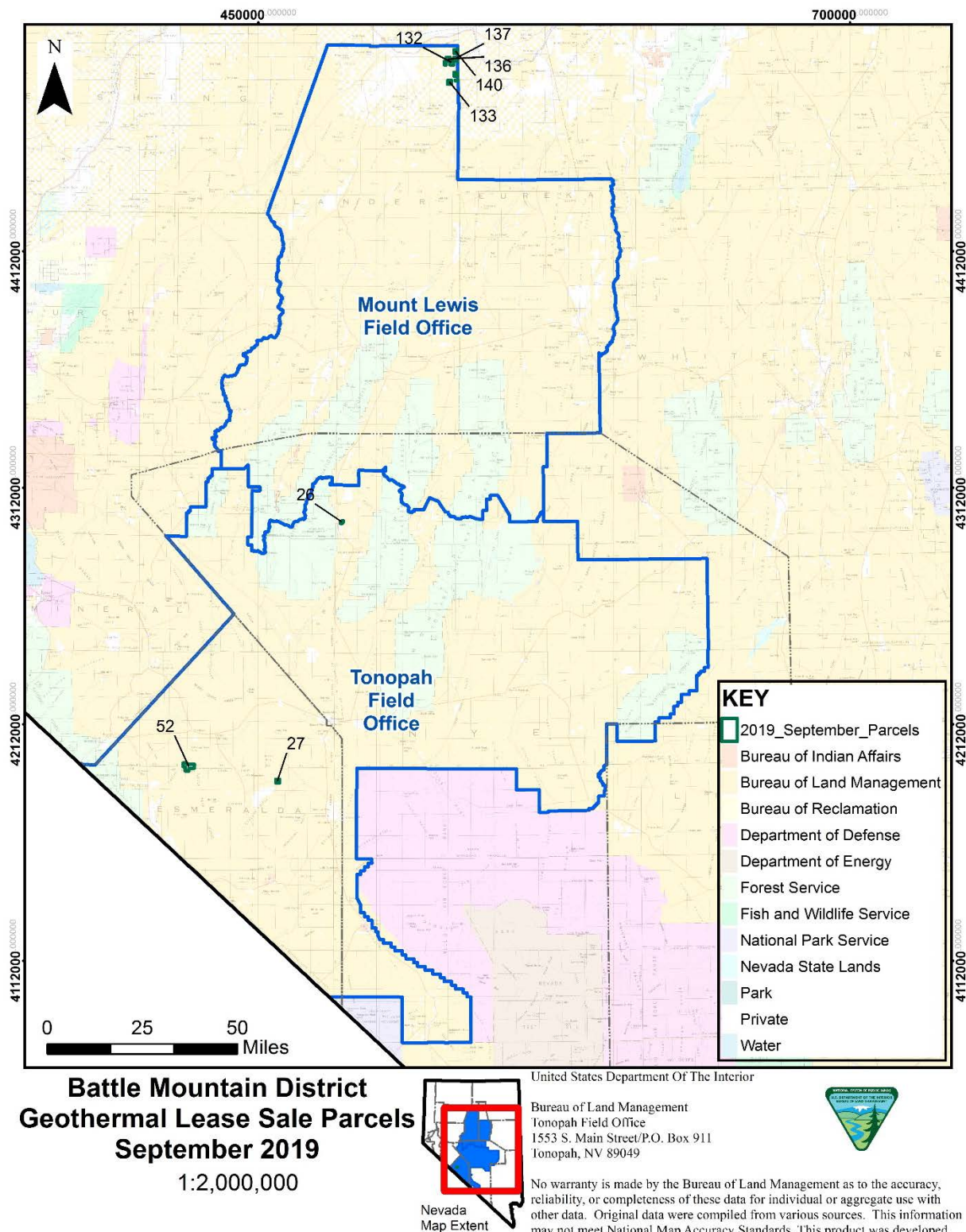


Figure 4 Proposed lease parcels with land status, Battle Mountain District.

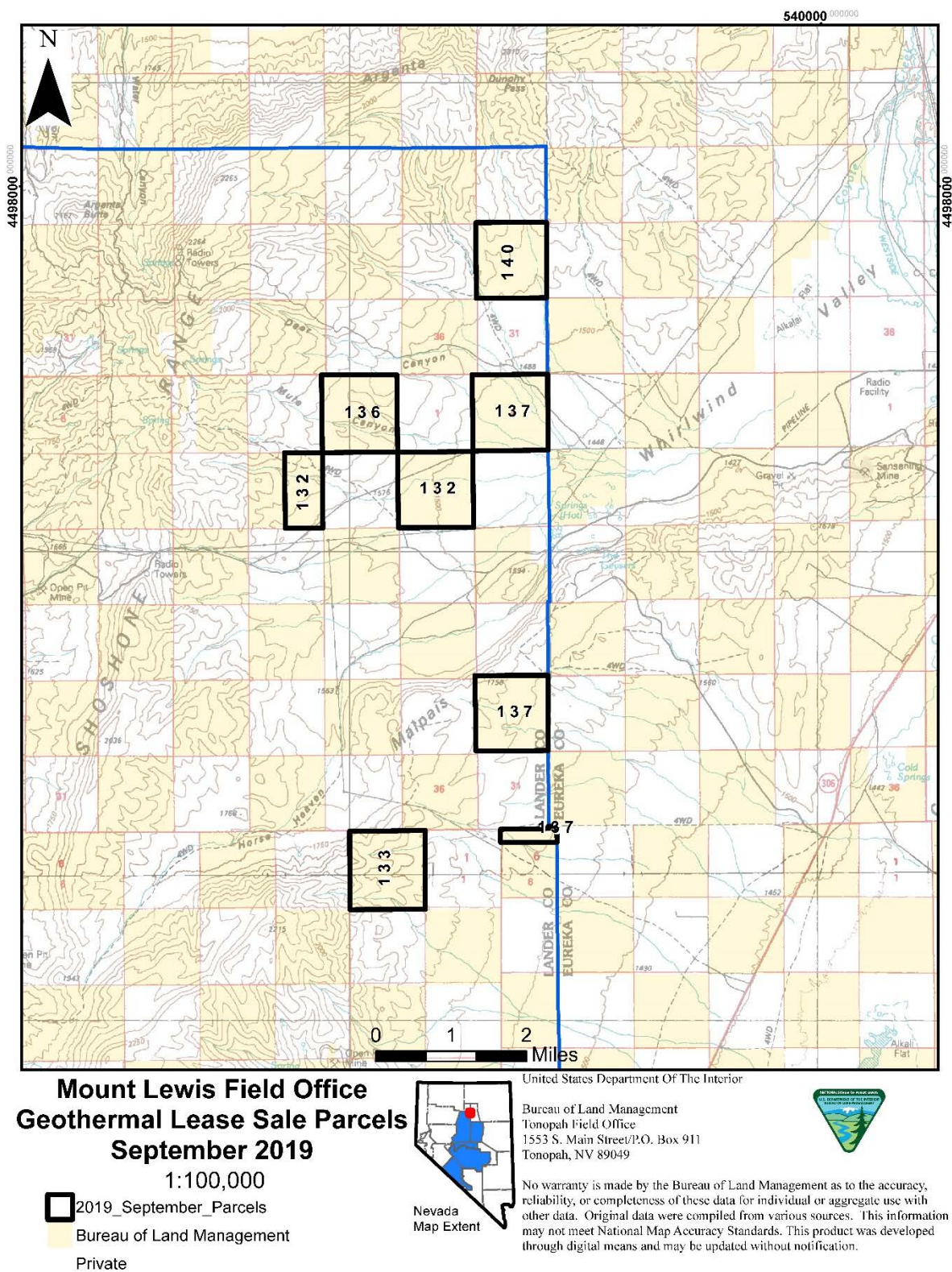


Figure 5 Land Status and proposed lease parcels in Mount Lewis Field Office.

1:100,000

United States Department Of The Interior

Bureau of Land Management
Tonopah Field Office
1553 S. Main Street/P.O. Box 911
Tonopah, NV 89049



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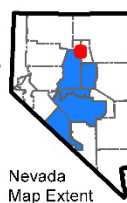


Figure 6 Water resources and proposed lease parcels in Mount Lewis Field Office.

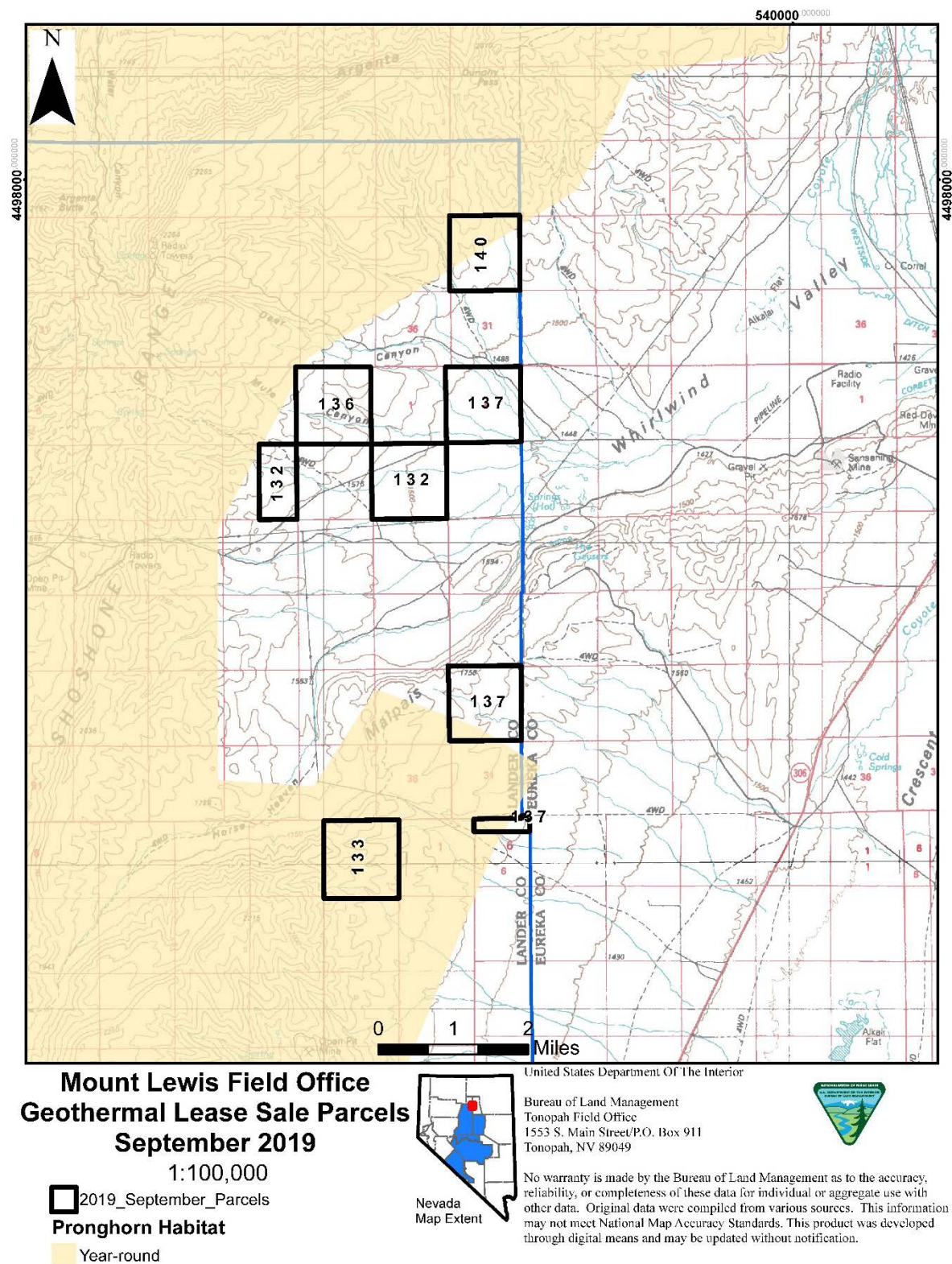


Figure 7 Pronghorn habitat and proposed lease parcels in Mount Lewis Field Office.

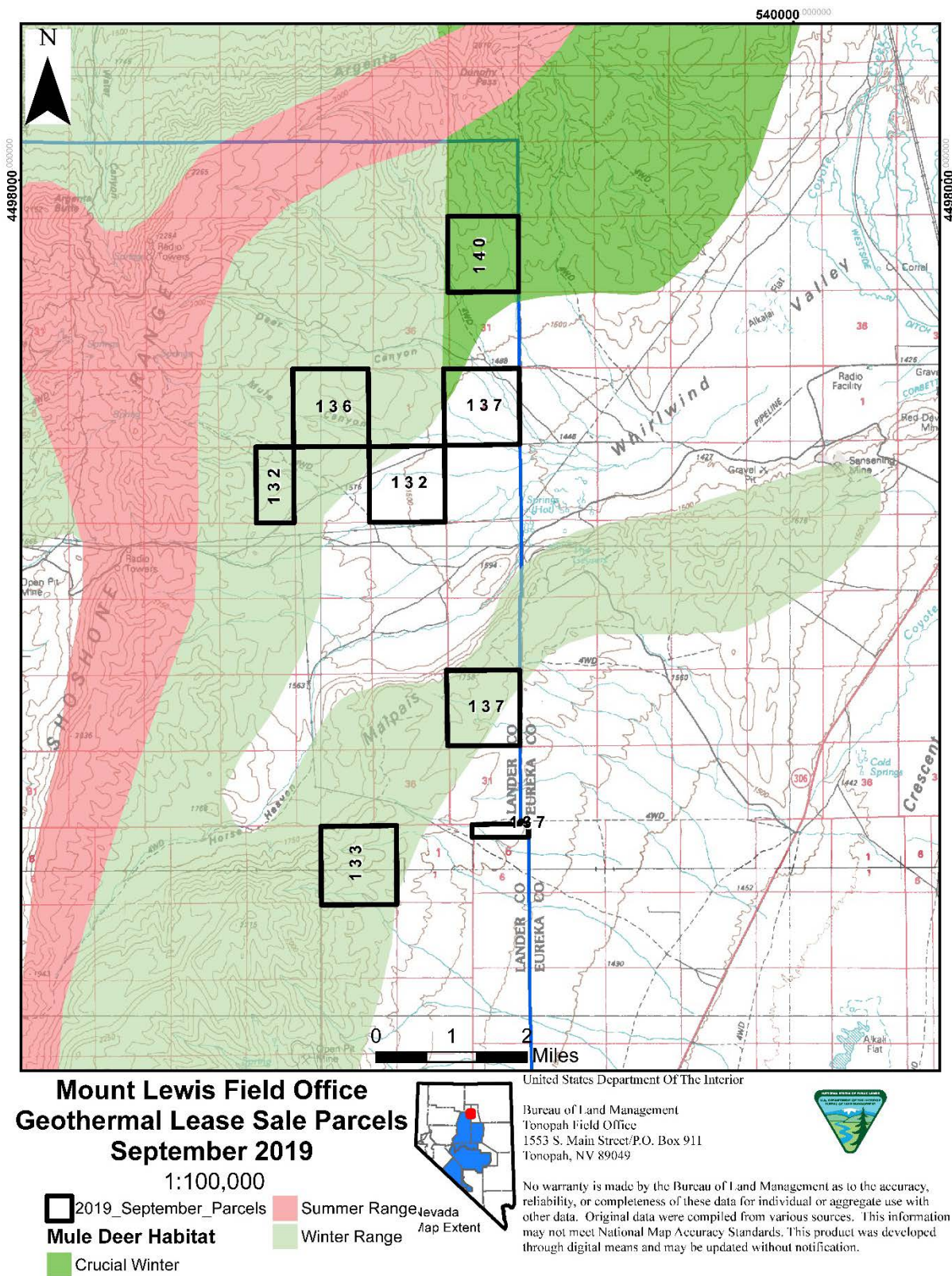


Figure 8 Mule Deer habitat and proposed lease sale parcels in Mount Lewis Field Office.

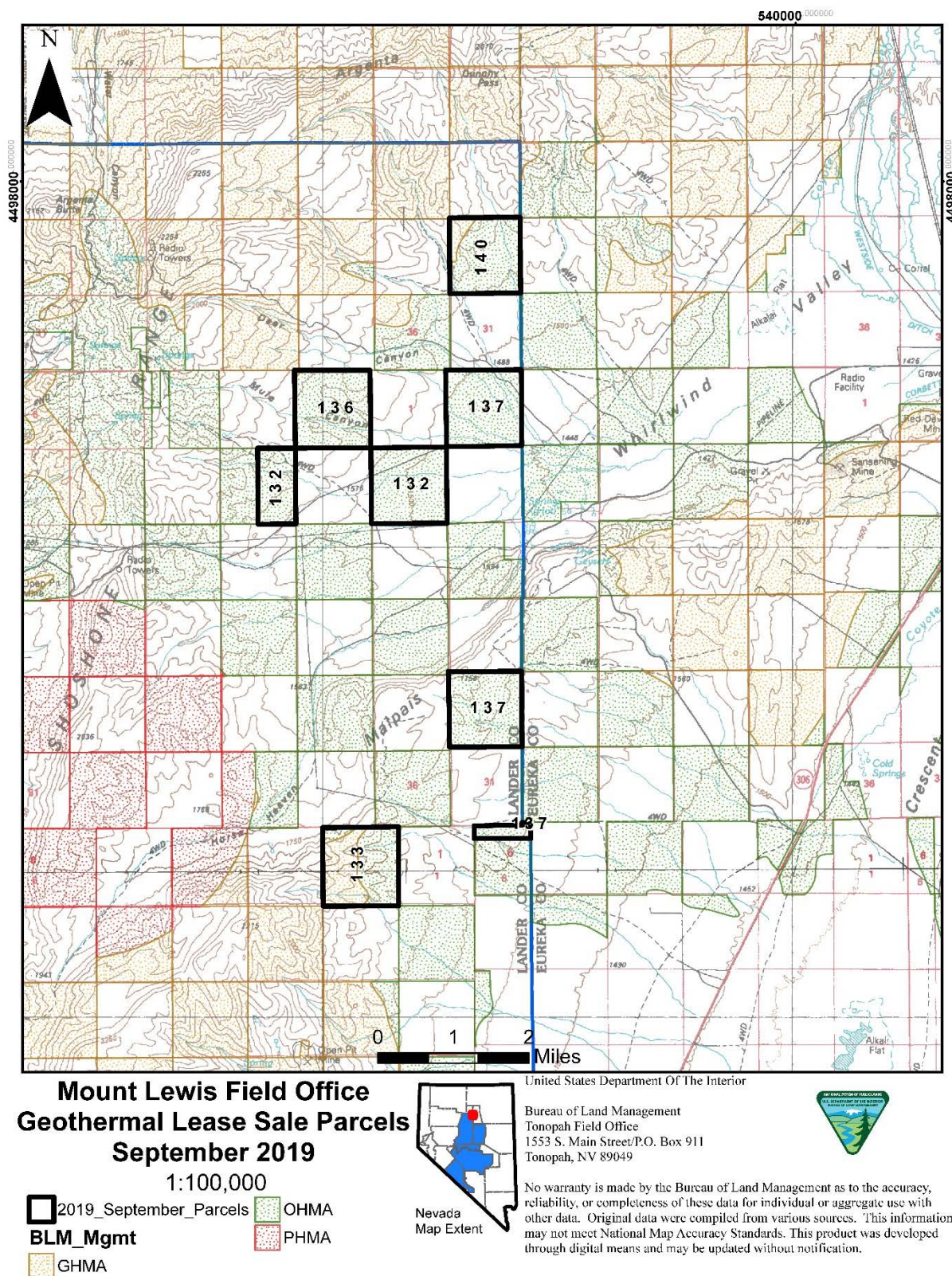


Figure 9 Greater sage-grouse habitat and proposed lease sale parcels in Mount Lewis Field Office.

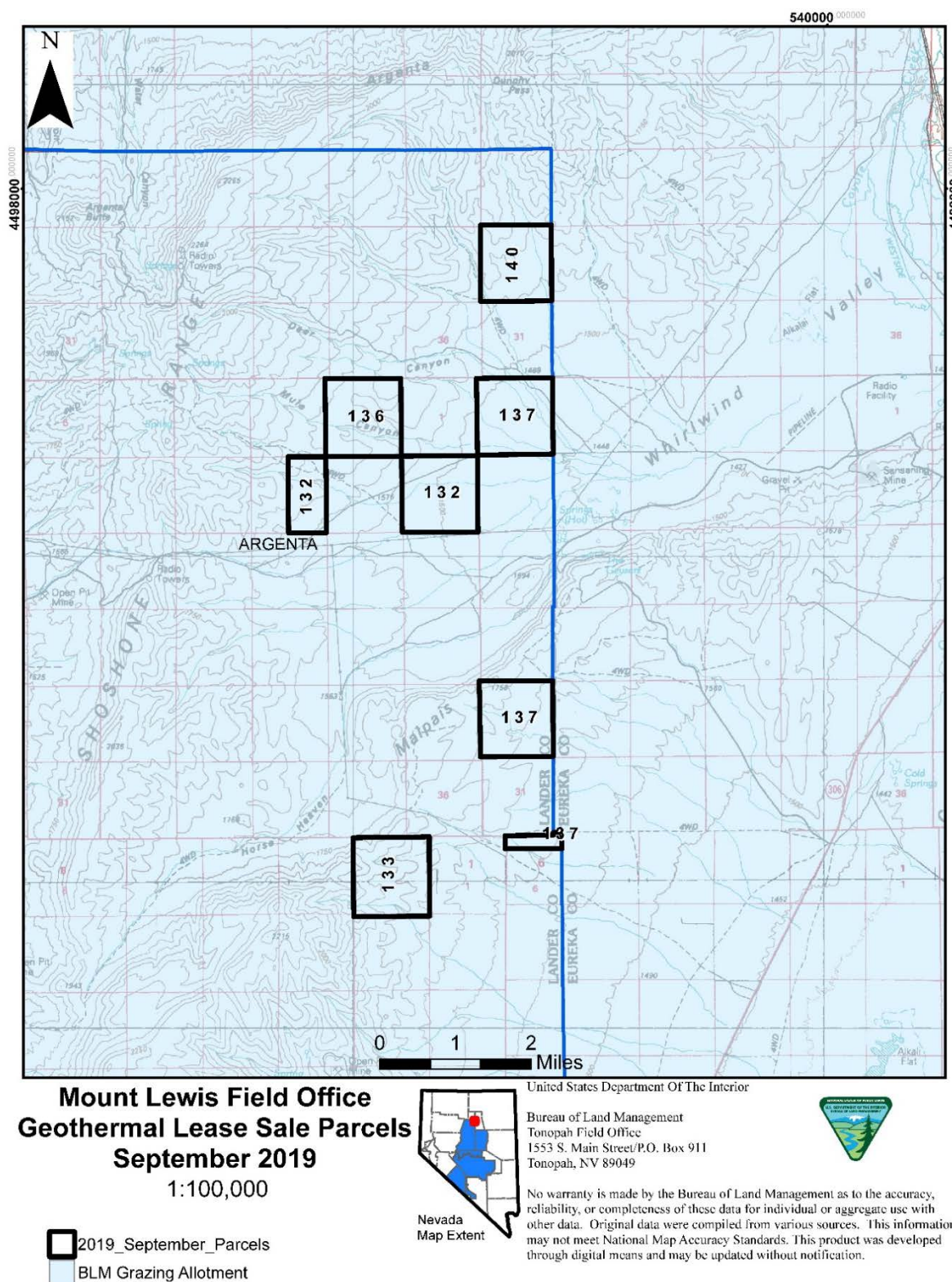


Figure 10 Grazing allotments and proposed lease parcels in Mount Lewis Field Office.

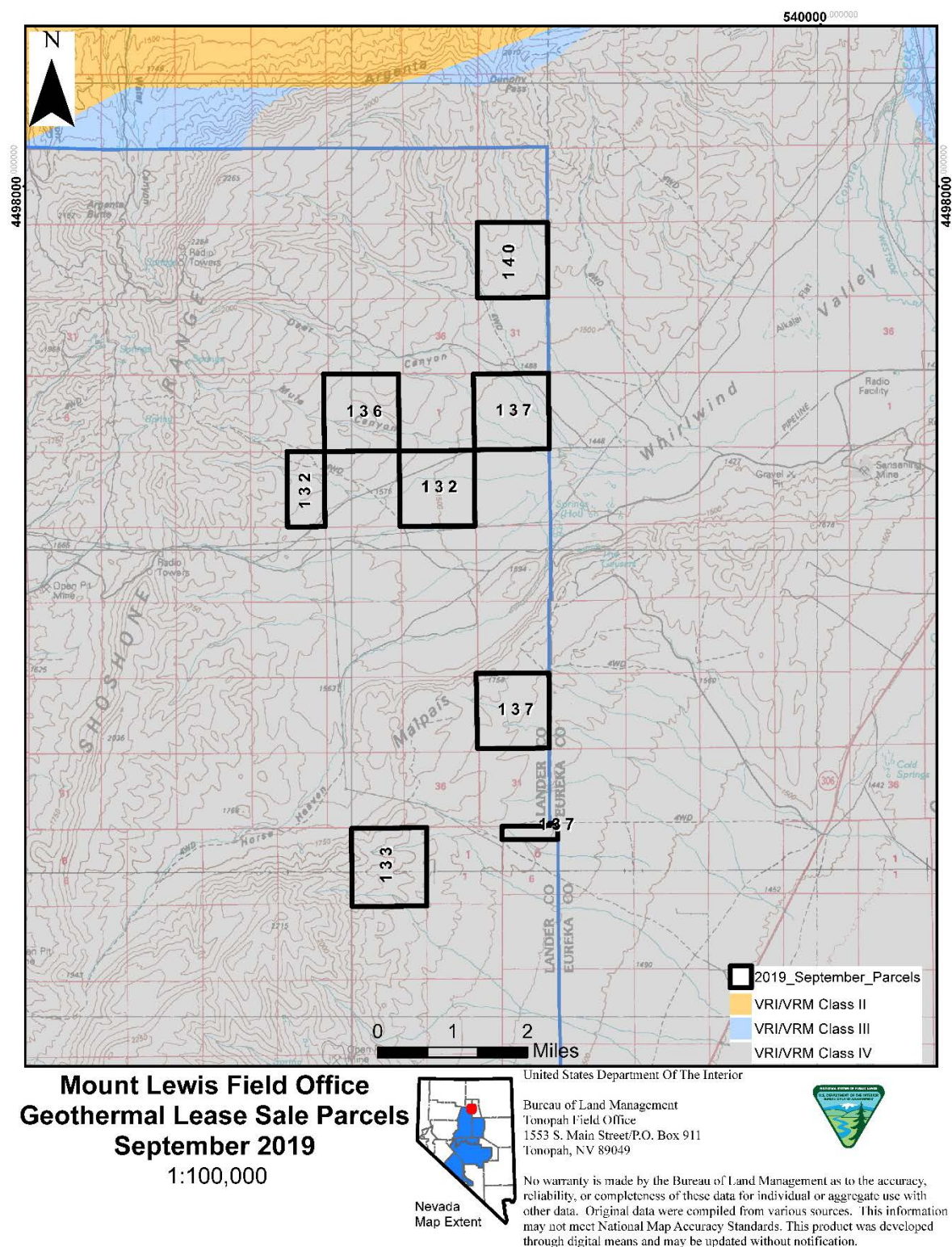


Figure 11 Visual Resource Inventory and proposed lease parcels in Mount Lewis Field Office.

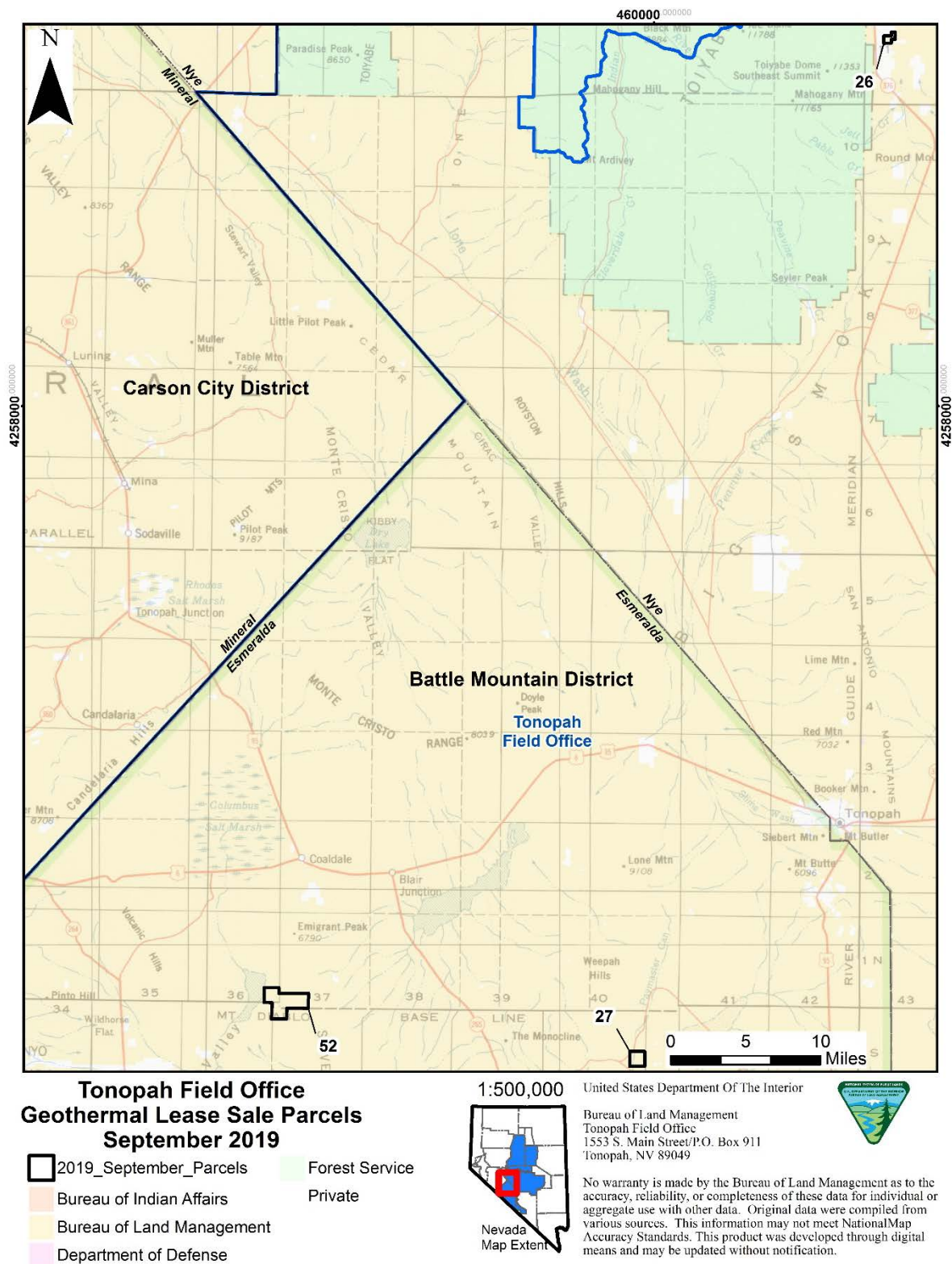


Figure 12 Land Status and proposed lease parcels in southern Tonopah Field Office.

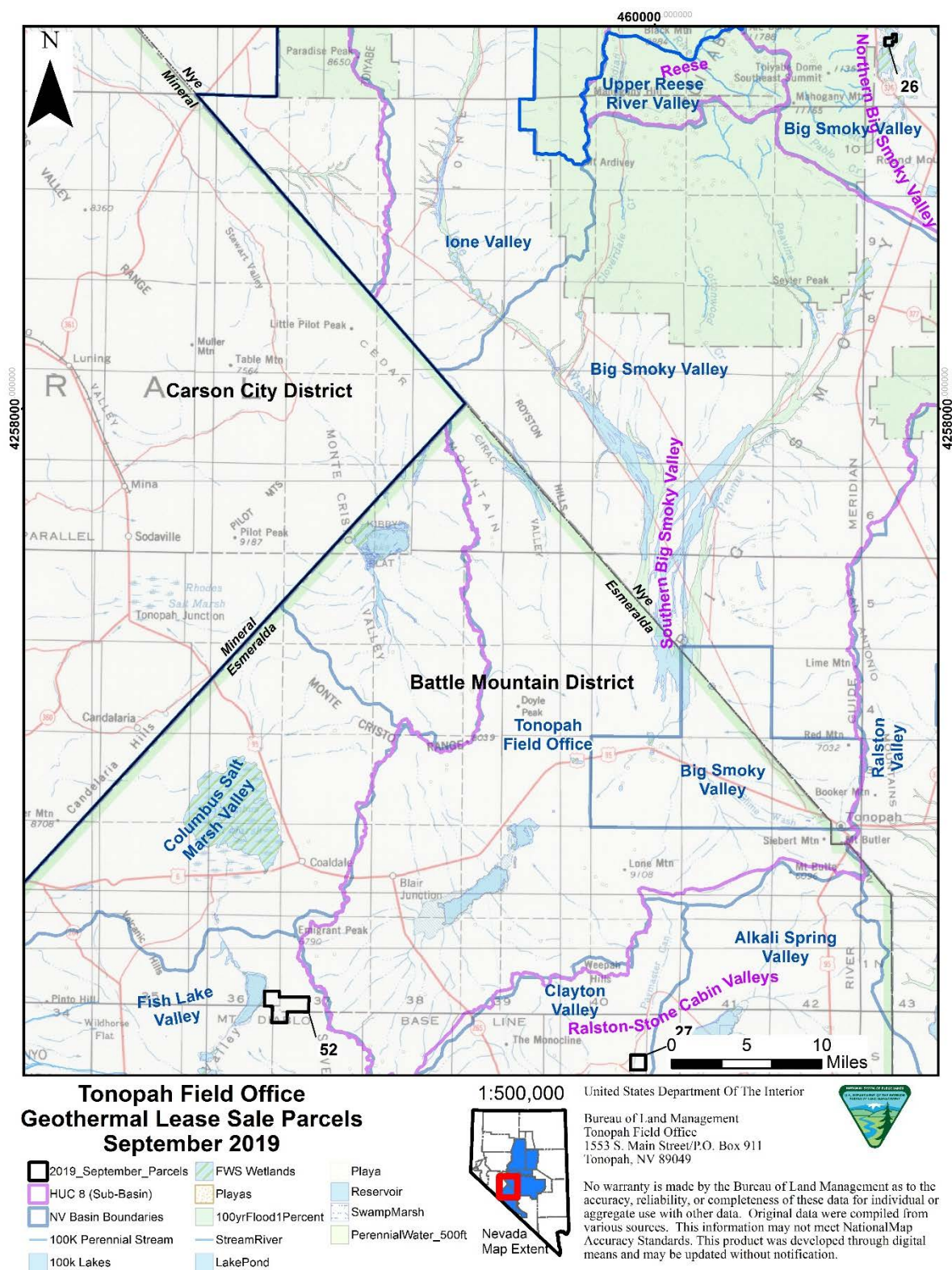


Figure 13 Water Resources and proposed lease parcels in Tonopah Field Office.

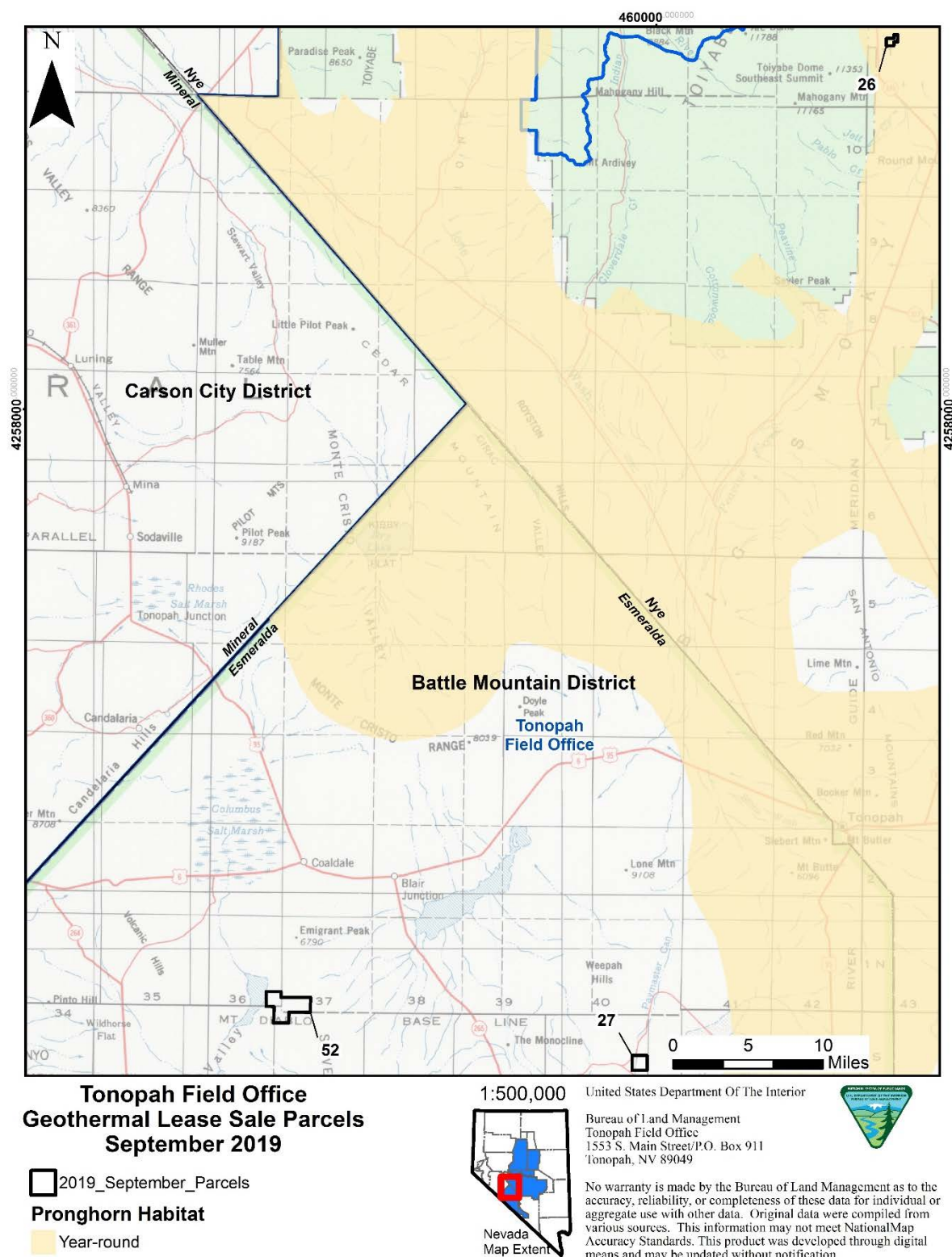


Figure 14 Pronghorn habitat and proposed lease parcels in Tonopah Field Office.

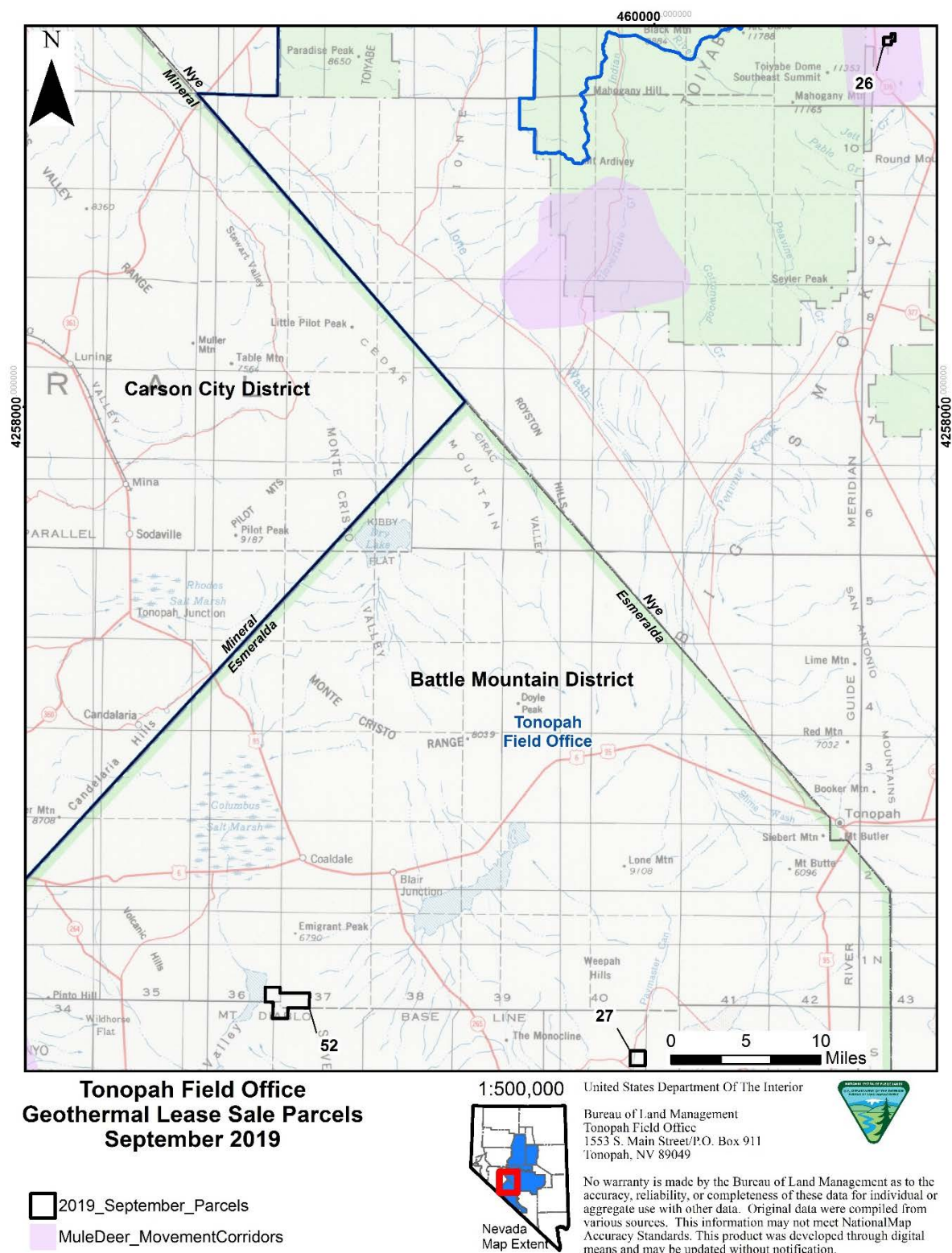


Figure 15 Mule deer movement corridors and proposed lease parcels in Tonopah Field Office.

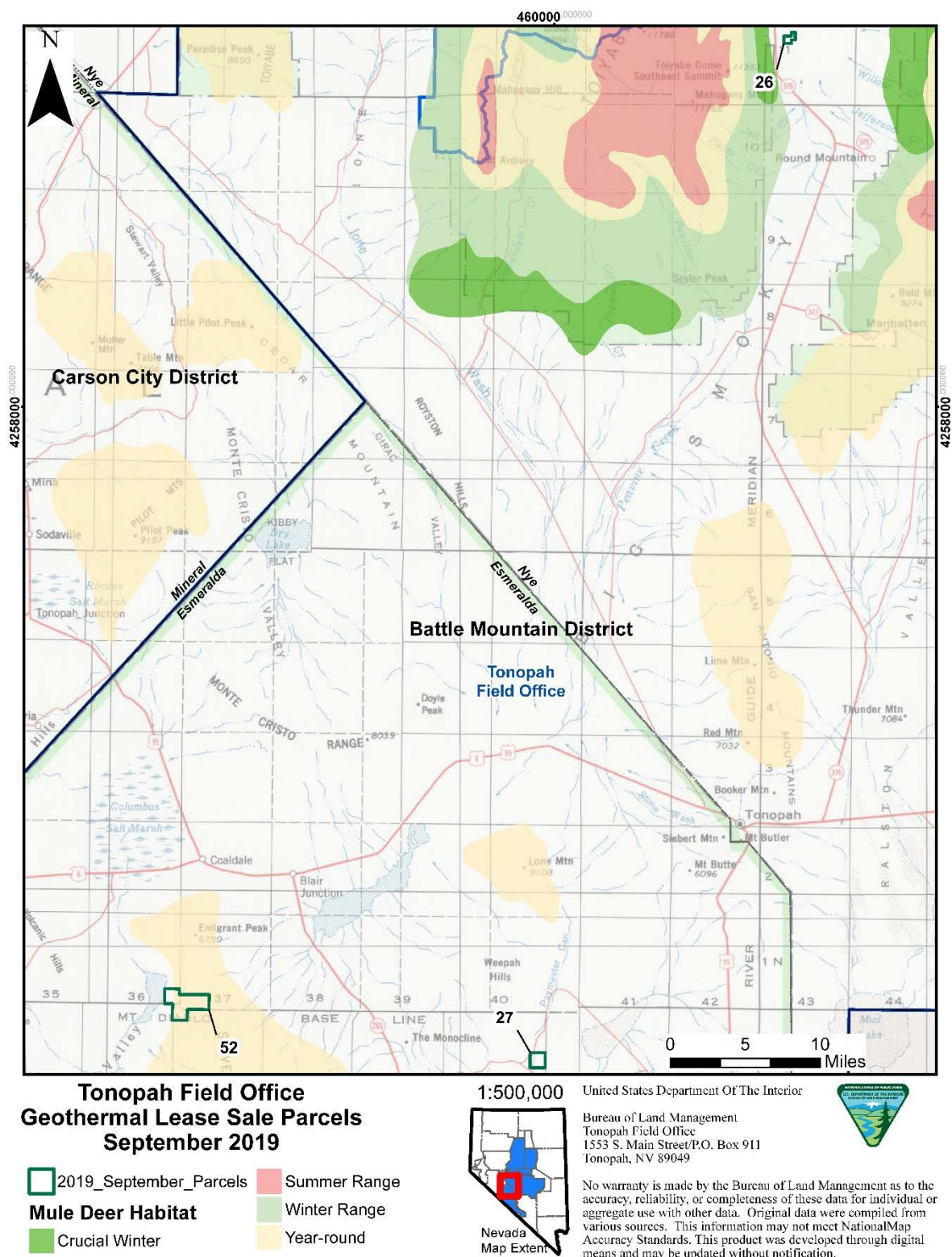


Figure 16 Mule Deer Distribution and proposed lease parcels in Tonopah Field Office.

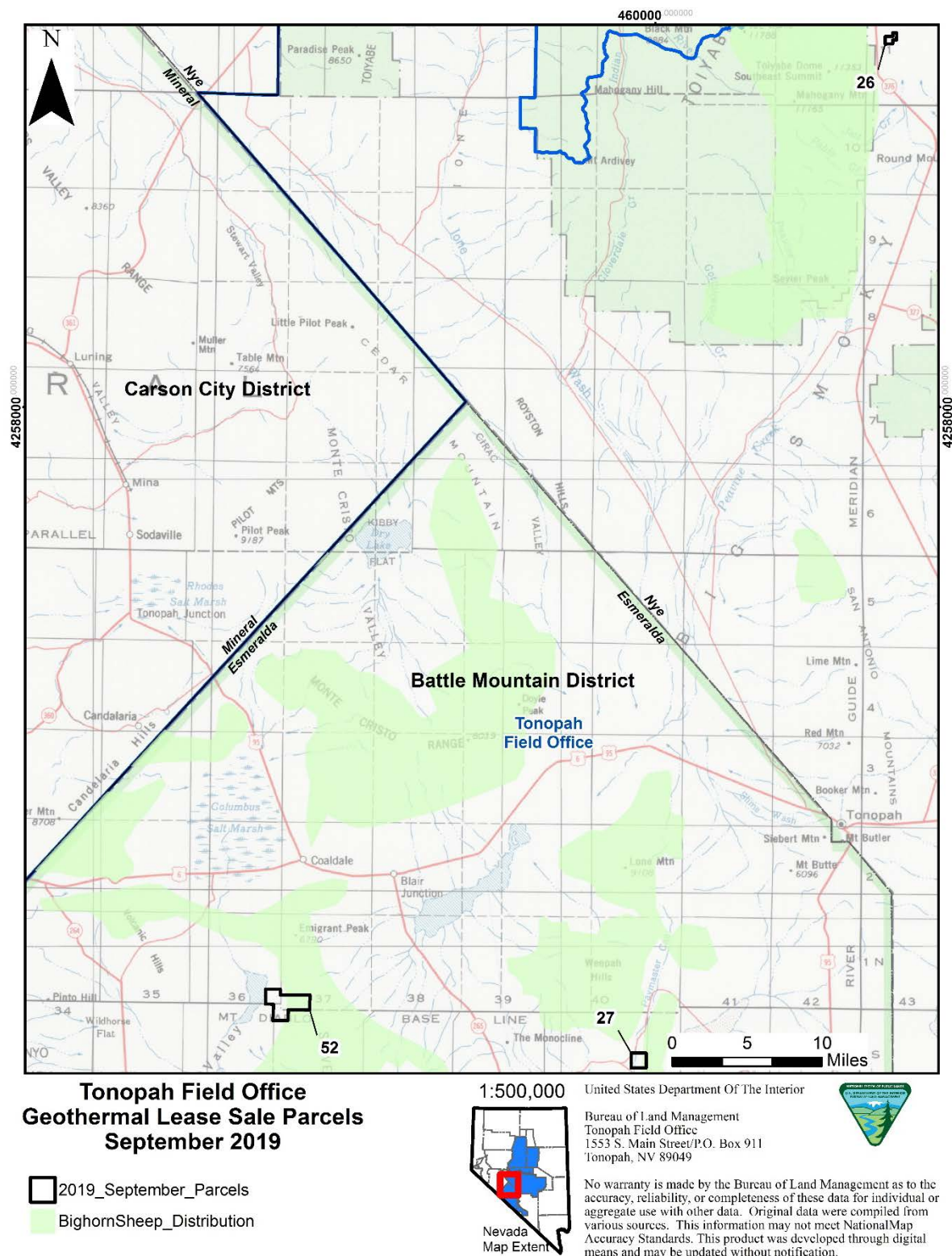


Figure 17 Bighorn sheep distribution and proposed lease parcels in Tonopah Field Office.

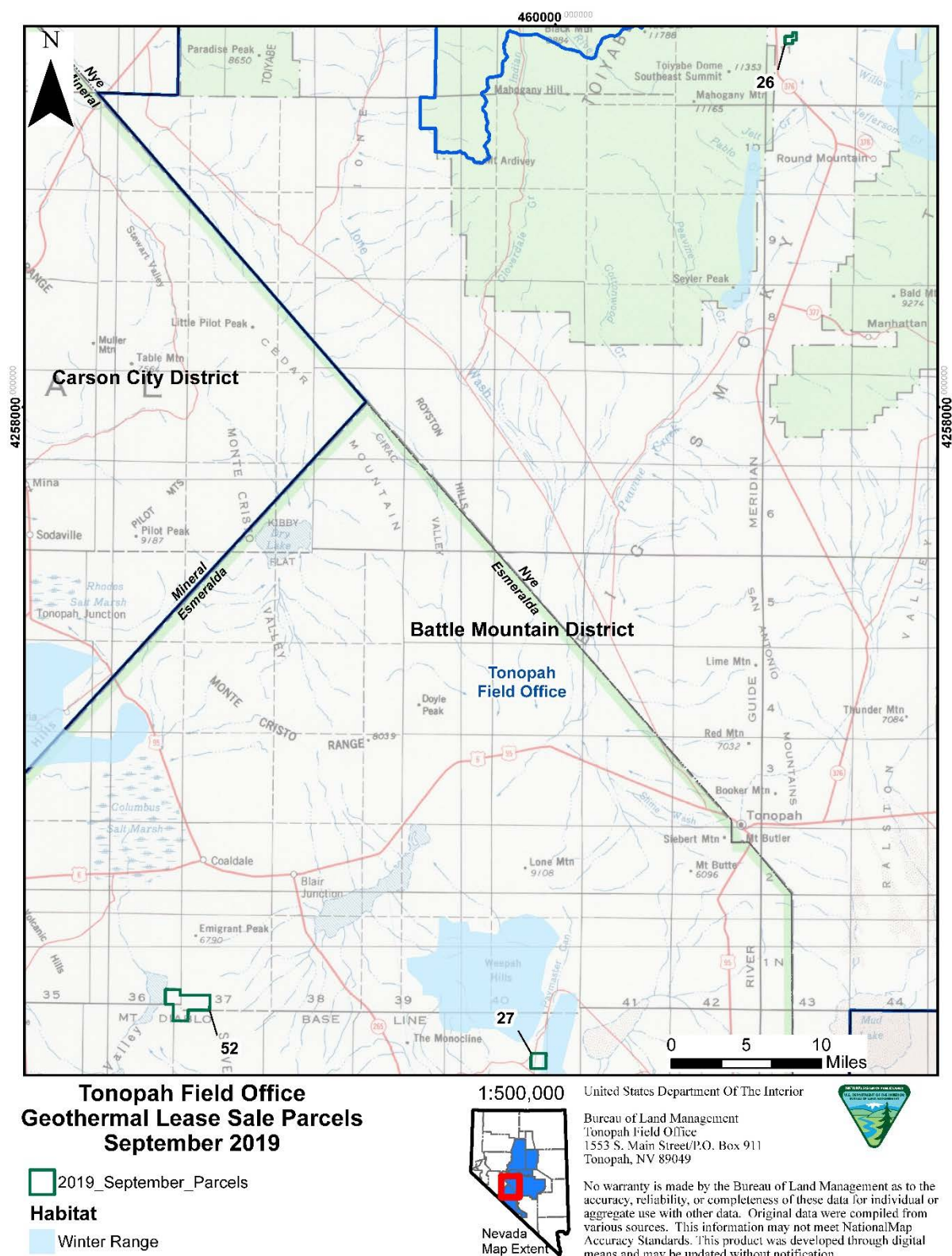


Figure 18 Bighorn Sheep winter range and proposed lease parcels in Tonopah Field Office.

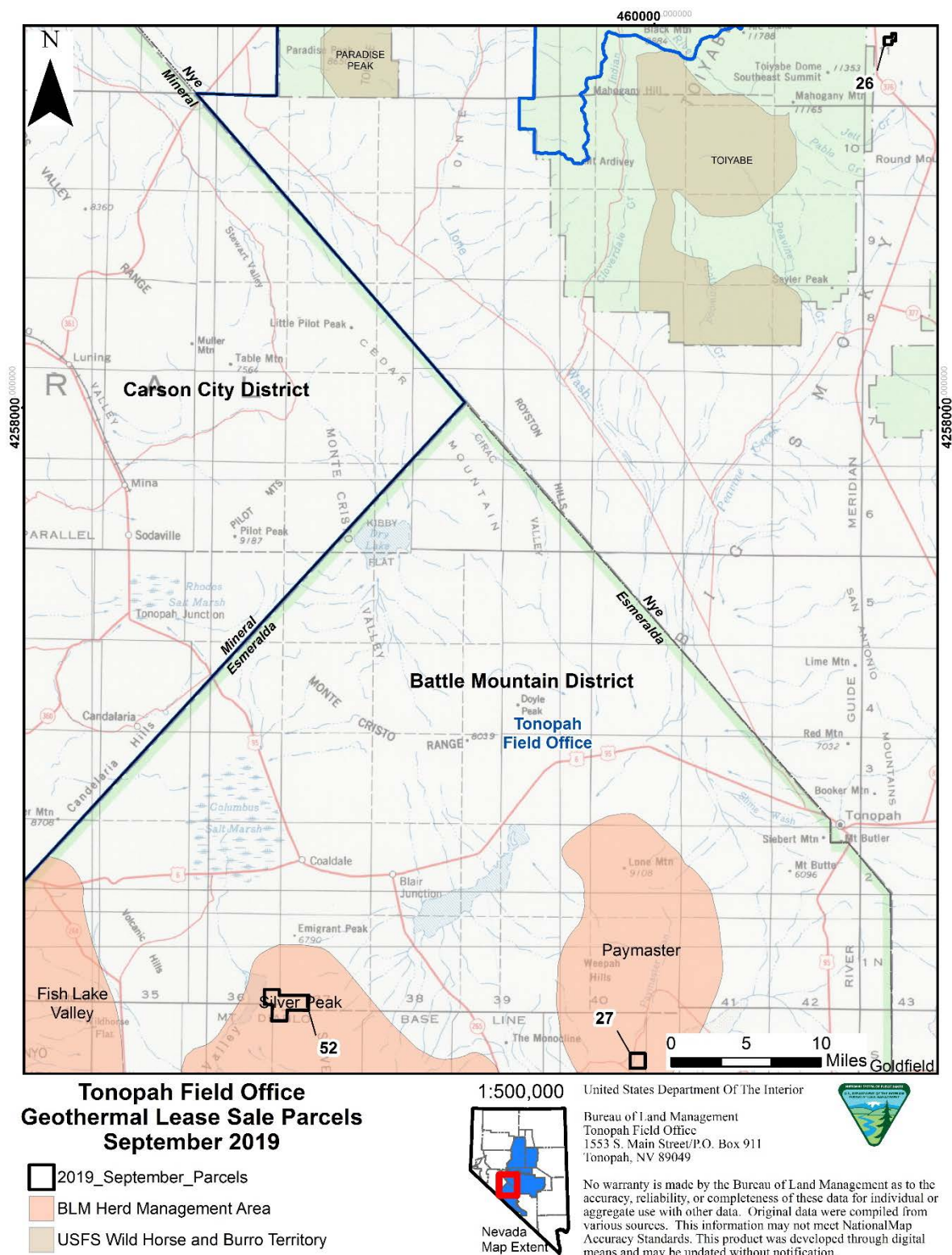


Figure 19 Wild horse and burro Herd Management Areas and proposed lease parcels in Tonopah Field Office.

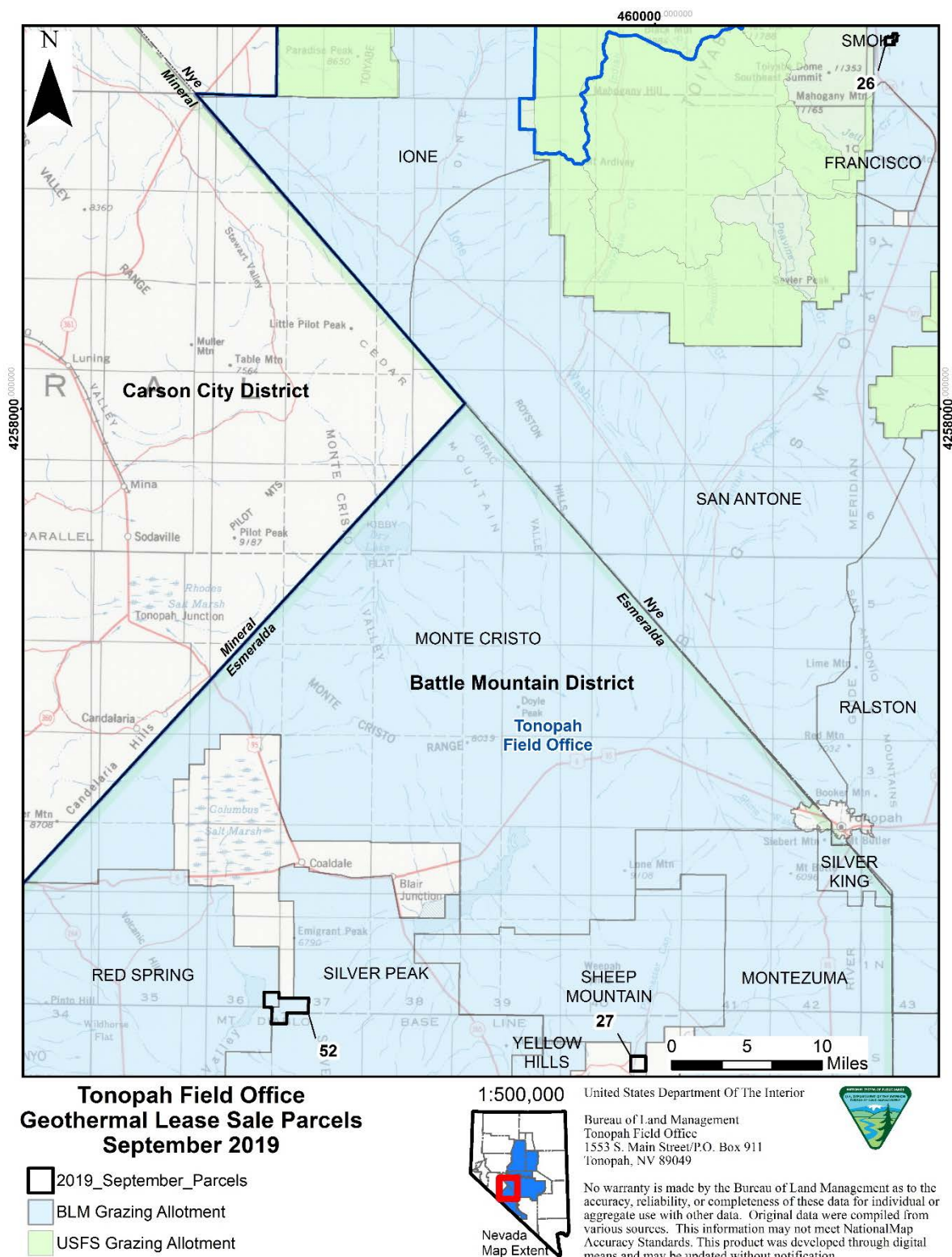


Figure 20 Grazing allotments and proposed lease parcels in Tonopah Field Office.

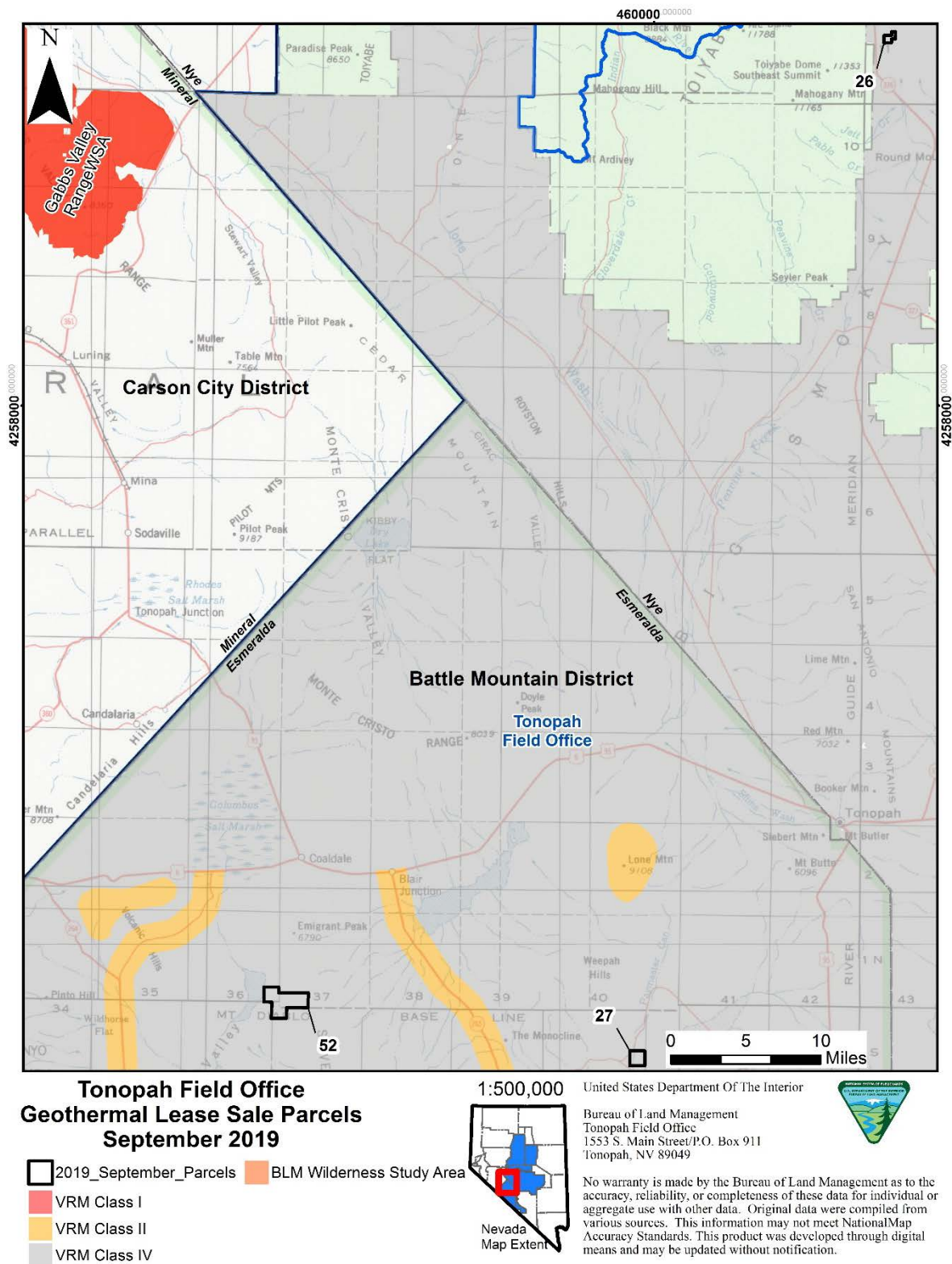


Figure 21 Visual Resource Management and proposed lease parcels in Tonopah Field Office.

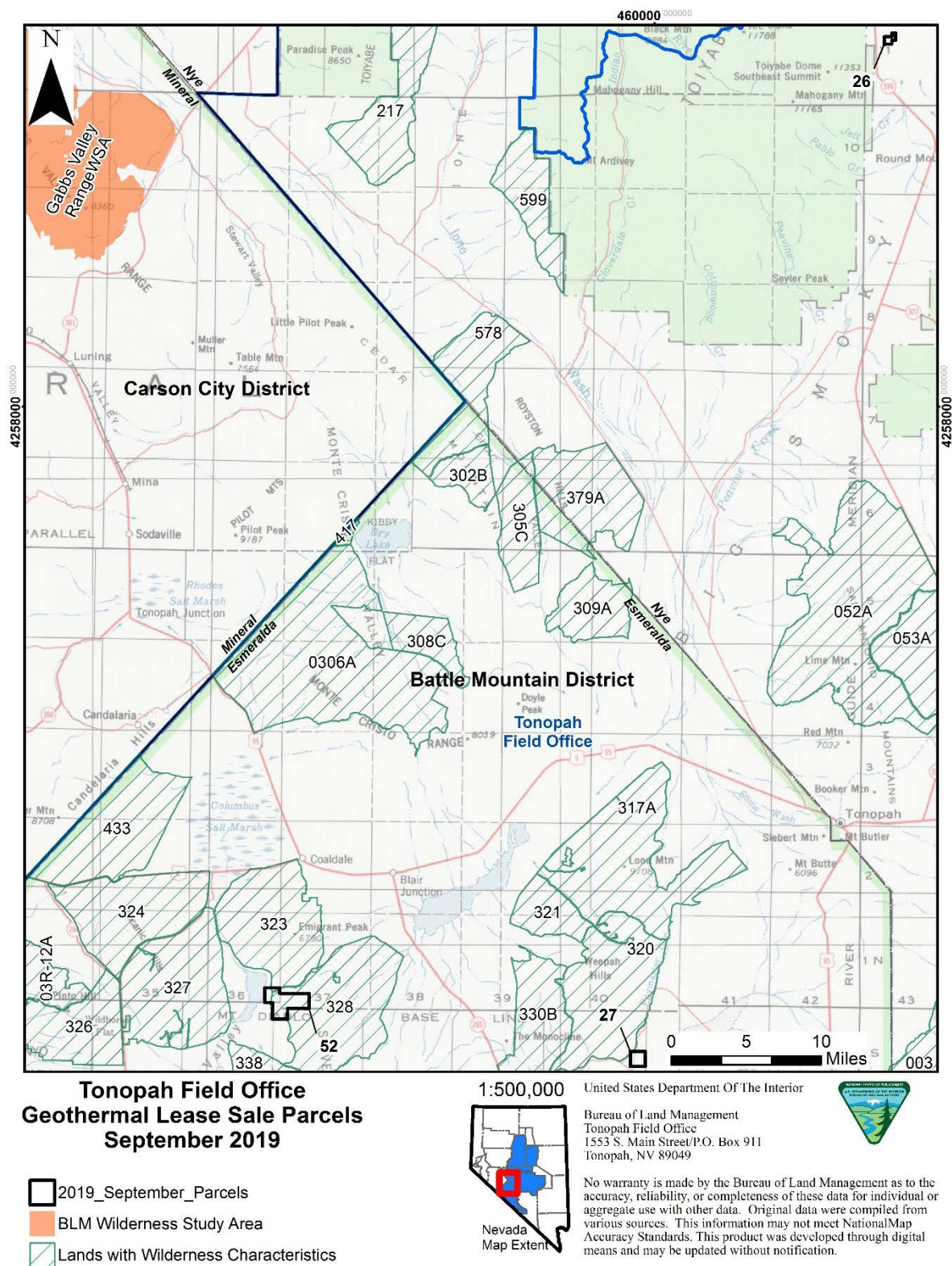


Figure 22 Wilderness characteristics inventory units and proposed lease parcels in Tonopah Field Office

Appendix L: Summary of Comments and Responses

BLM Received comments on the EA from the following:

Appendix L-Table 1: Comments and responses from comment period.

From	Comment	Response