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

Ormat Technologies, Inc.
Leach Hot Springs
Geothermal Exploration Project

ENVIRONMENTAL ASSESSMENT
DOI-BLM-NV-W010-2011-0001-EA

April 2011

U.S. Department of the Interior
Bureau of Land Management
Humboldt River Field Office
5100 E. Winnemucca Blvd.
Winnemucca, Nevada 89445
Phone: 775-623-1500
Fax: 775-623-1503

Cooperating Agencies:

Nevada Department of Wildlife
1100 Valley Road
Reno, Nevada 89512

University of Nevada Cooperative Extension
1085 Fairgrounds Road
Winnemucca, Nevada 89445

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BLM/NV/WN/EA/11-08+1792

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LIST OF ACRONYMS

AFY	Acre-feet per year
AIRFA	American Indian Religious Freedom Act
ARPA	Archaeological Resources Protection Act
AUM	Animal unit month
BAPC	Bureau of Air Pollution Control
BLM	Bureau of Land Management
BMP	Best Management Practices
BOPE	Blowout prevention equipment
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH_4	Methane
CIAA	Cumulative Impacts Assessment Area
CO	Carbon monoxide
CO_2	Carbon dioxide
DOE	Determination of eligibility
EPA	Environmental Protection Agency
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FLPMA	Federal Land Policy and Management Act
GDP	Geothermal Drilling Permit
GHG	Greenhouse gases
GIS	Geographic Information System
gpm	gallons per minute
H_2S	Hydrogen sulfide
HRFO	Humboldt River Field Office
HUC	Hydrologic Unit Code
IDA	International Dark-Sky Association
JBR	JBR Environmental Consultants, Inc.
KGRA	Known Geothermal Resource Areas
LCT	Lahontan Cutthroat Trout
MBTA	Migratory Bird Treaty Act
MFP	Management Framework Plan
NAAQS	National Ambient Air Quality Standards
NAC	Nevada Administrative Code
NAGPRA	Native American Graves Protection and Repatriation Act
NDEP	Nevada Division of Environmental Protection
NDOM	Nevada Division of Minerals
NDOT	Nevada Department of Transportation
NDOW	Nevada Department of Wildlife
NDWR	Nevada Division of Water Resources
NEPA	National Environmental Policy Act
NH_3	Ammonia
NHPA	National Historic Preservation Act

NNHP	Nevada Natural Heritage Program
NO_2	Nitrogen dioxide
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRS	Nevada Revised Statutes
O_3	Ozone
OHV	Off-highway vehicle
OHWM	Ordinary high water mark
OSHA	Occupational Safety and Health Association
Pb	(Elemental) lead
PFYC	Potential Fossil Yield Classification
ppm	parts per million
PLS	Pure live seed
PMU	Population management unit
PRIA	Public Rangelands Improvement Act
PVC	Polyvinyl chloride
RFFAs	Reasonably Foreseeable Future Actions
ROW	Right-of-Way
SCS	Soil Conservation Service
SHPO	State Historic Preservation Officer
SO_2	Sulfur dioxide
SWReGAP	Southwest Regional Gap Analysis Project
TCP	Traditional Cultural Properties
TGA	Taylor Grazing Act
UNCE	University of Nevada Cooperative Extension
USC	United States Code
USDOI	U.S. Department of the Interior
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
VRM	Visual Resource Management
WCRM	Western Cultural Resource Management
WRCC	Western Regional Climate Center

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

In mid-2006, Ormat Technologies, Inc. (Ormat), through its wholly owned subsidiary ORNI 26, LLC, purchased two federal geothermal leases (NVN-74276 and NVN-76458) in the Leach Hot Springs area from Great Basin Geothermal, LLC. Ormat also purchased an additional geothermal lease (NVN-85717) adjacent to the other two from the Bureau of Land Management (BLM) for a total of three federal geothermal leases. The geothermal leases (NVN-74276, NVN-76458, and NVN-85717) held by Ormat form the Leach Hot Springs Lease Area (Lease Area), comprise 5,267 acres, and are located entirely on public lands managed by the BLM. The Lease Area is approximately 25 miles south of Winnemucca, in Pershing County, Nevada (Figure 1). The Lease Area is located within the following sections or parts thereof of the following Townships and Ranges:

- Township 31 North, Range 38 East (T31N, R38E), section 1.
- T32N, R38E, sections 25 and 36.
- T31N, R39E, sections 5 and 6.
- T32N, R39E, sections 30, 31, 32, and 33.

Note that all legal land descriptions provided in this document are based on the Mount Diablo Base and Meridian.

The BLM Humboldt River Field Office (HRFO) received a geothermal operations plan from Ormat on May 17, 2010, under the provision of Title 43, subpart 3261 of the Code of Federal Regulations (43 CFR 3261.12). After review, a revised plan was received on June 4, 2010, and found acceptable. The operations plan describes the construction of up to 12 well pads, each sized to accommodate the drilling of each of three different types of geothermal exploration wells: temperature gradient wells, observation wells, and production wells. The operations plan also describes improvement of existing access roads and construction of new access roads, expansion of an existing mineral material site, and construction and installation of the ancillary facilities necessary for the project. Ancillary facilities would include a temporary personnel "camp" and up to two groundwater wells on one or two of the proposed well pads and associated above-ground water distribution pipeline. Although the Lease Area consists of approximately 5,267 acres, only a fraction of the area would potentially be impacted by proposed geothermal exploration at this time. Ormat has identified an area where the proposed 12 well pads and access roads would be constructed or improved, hereby referred to as the Project Area (Figure 2). Exploration activities and surface disturbances would not occur outside the limits of the Project Area, including disturbance associated with the expansion of an existing mineral material site (Ormat 2010). The Project Area occurs entirely on public lands administered by the BLM (Figure 3).

Under the provisions of 43 CFR 3261.11 and 3261.13, a complete drilling program and individual Geothermal Drilling Permits (GDPs) would be submitted to the BLM individually as the project progresses for authorization prior to well pad construction and drilling.

1.2 PURPOSE AND NEED

The BLM's purpose is to provide Ormat with the ability to conduct geothermal exploration activities on its federal geothermal leases through the construction and drilling of up to 12 well pads, construction of new on-lease access roads and improvement of existing on-lease access roads, expansion of the existing mineral material site, installation of support and ancillary facilities, and drilling of up to two new groundwater wells in a manner that ensures the exploration proceeds as allowed by the terms of the leases and any special stipulations that have been made part of the leases.

The need for the action is established by the BLM's responsibility under the Geothermal Steam Act of 1970 and the implementing regulations provided under 43 CFR 3200.

Decisions to be Made

The BLM will decide whether to approve the operations plan and if so under what conditions of approval. These conditions of approval would be applied to the GDPs when they are issued.

1.3 LAND USE PLAN CONFORMANCE

The Project Area is subject to the BLM, Winnemucca District Office Sonoma-Gerlach Management Framework Plan (MFP), dated July 9, 1982 (BLM 1982). Objective M-5 of the Sonoma-Gerlach MFP states: "Make energy resources available on all public lands and other lands containing federally owned minerals." The MFP provides for the development of geothermal resources in noncompetitive areas and all Known Geothermal Resource Areas (KGRAs), except those that are areas of significant environmental conflict or have historical and/or cultural significance as defined in the District Manager's Decision. The Proposed Action is in conformance with the MFP.

1.4 RELATIONSHIP TO LAWS, REGULATIONS, POLICIES, OTHER PLANS, AND OTHER ENVIRONMENTAL ANALYSES

The Environmental Assessment (EA) has been prepared in accordance with the following statutes and implementing regulations, policies and procedures:

- The National Environmental Policy Act (NEPA) of 1969, as amended (Public Law 91-190, 42 USC 4321) (*et seq.*).
- 40 CFR 1500 (*et seq.*). Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act.

- The Council on Environmental Quality's (CEQ) *Considering Cumulative Effects under NEPA* (1997).
- 43 CFR Part 46, Implementation of the National Environmental Policy Act (NEPA of 1969); Final Rule, effective November 14, 2008.
- U.S. Department of the Interior (USDOI) requirements provided in Part 516, Chapters 1 through 15, of the Departmental Manual (USDOI 2004).
- BLM NEPA Handbook (H-1790 1), as updated (BLM 2008a).
- The Geothermal Steam Act of 1970, Title 30, United States Code (USC), Chapter 23, Sections 1001 et seq. (30 USC 1001 et seq.).
- 43 CFR 3200, Geothermal Resources Leasing and Operations; Final Rule, May 2, 2007.
- The 2005 Energy Policy Act; The National Energy Policy, Executive Order 13212.
- Best Management Practices (BMPs) as defined in *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, Fourth Edition* (Gold Book) (BLM 2007).

In 2002, the BLM Winnemucca District Office completed the "Geothermal Resources Leasing Programmatic Environmental Assessment" (BLM 2002). Special stipulations developed in the Programmatic EA were applied to geothermal leases subsequently issued by the BLM, including the three (N-74276, N-76458, and N-85717) federal leases that are the subject of this EA. In 2008, the BLM completed the Programmatic Environmental Impact Statement (EIS) for Geothermal Resources Leasing in the Western United States (BLM 2008b). Special stipulations developed in this Programmatic EIS were applied to geothermal resource leases subsequently issued by BLM; however, the three leases that are the subject of this EA predate issuance of the EIS. Copies of the stipulations for all three leases are attached to this EA as Appendix A. Ormat is required to comply with these lease stipulations.

The Proposed Action would be subject to other applicable state and local permits prior to beginning construction.

1.5 ISSUES

A scoping process was conducted in order to determine the scope of this environmental analysis. The BLM and its cooperating agencies (Nevada Department of Wildlife [NDOW] and University of Nevada Cooperative Extension [UNCE] in this case) staff defined issues and made initial determination of what needed to be analyzed in this EA (see Chapter 3, Description of the Affected Environment), data needs, possible alternatives, and public outreach needs.

This was followed by external scoping where other agencies, organizations, tribes, local governments, and the public are provided the opportunity to provide feedback regarding issues, concerns, data needs, and such things as potential alternatives. This assists the BLM in refining issues and identifying any new issues, coordination needs, possible alternatives, and so forth.

A letter and map were sent to a mailing list of potentially interested members of the public on July 27, 2010. The scoping letter and map were also posted on the BLM's Winnemucca District NEPA Web page.

The BLM heard from the EPA, the Nevada Division of State Lands, the Nevada Division of Water Resources (NDWR), the Nevada Department of Transportation (NDOT), and adjacent landowners. The BLM also heard from NDOW through its role as Cooperating Agency in the development of this EA and tribal governments through government-to-government consultation. Government-to-government consultation was conducted with affected tribal governments (see sections on Native American Religious Concerns and Chapter 7, Consultation and Coordination).

Through internal and external scoping, the following issues were identified with regard to the Proposed Action:

- What potential effects on air quality could occur as a result of the Proposed Action?
- How could existing cultural resources, including archaeological sites and Traditional Cultural Properties (TCP), be affected by implementation of the Proposed Action?
- How could the Proposed Action affect the spread of invasive, non-native species?
- How could migratory birds be affected by implementation of the Proposed Action?
- What potential effects could occur on traditional Native American religious concerns and lifestyles, including potential effects on surface water resources?
- What is the potential for hazardous or solid wastes to affect the environment as a result of the Proposed Action?
- What potential impacts to surface or ground water quality could occur as a result of the Proposed Action?
- How could soils and vegetation be affected by the Proposed Action?
- What potential impacts could occur to wildlife resources and special status species?
- How would the project affect existing land use authorizations?
- How would public access and public recreation be affected by the Proposed Action?
- How would water flow and temperature at the spring on private land adjacent to the Project Area be impacted?
- What direct, indirect, and cumulative impacts are expected from lighting?
- What measures would be taken to properly direct and shield light?
- What impacts are expected from fugitive and combustion sources from construction, during exploration, and through reclamation?
- What impacts are expected from hydrogen sulfide and other dissolved gases?
- How would the project's water supply affect groundwater and other users and resources?
- Natural seismic hazards and any induced seismic activity that would be created from the proposed action need to be addressed.
- How would increased traffic on Grass Valley Road affect public safety?
- How would undesirable activities caused by having worker camps at the site be minimized or eliminated?

- How would implementation of the project affect the spread of noxious weeds? Would a coordinated noxious weed monitoring and control effort be required?

CHAPTER 2
DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

Ormat proposes to evaluate the geothermal resources that potentially exist within the Lease Area by constructing up to 12 well pads and drilling one of each of the three different types of geothermal exploration wells on each pad: temperature gradient wells, observation wells, and production wells. Therefore a total of 36 geothermal exploration wells may be drilled as part of the Proposed Action. Each well pad would be permitted to accommodate the maximum approximate size necessary for the construction and operation of a production well, the largest of the three types. The drilling of each well type may not necessarily occur on each well pad, only one well of each well type would be drilled on any single well pad, and not all well pads may be utilized or developed. While each pad site would be permitted to accommodate a production well, pad sites would be constructed to the extent necessary to accommodate the well type(s) situated on it. If Ormat initially drills a temperature gradient well or observation well on a pad site, that pad site would not be expanded to full permitted size unless a production well is later drilled on it. Under no circumstances would a pad site be expanded to a size greater than that prescribed for a production well. Specific details about the design and layout of well pads are provided in Section 2.1.2.1.

In support of the geothermal exploration drilling activities, Ormat also proposes to construct new gravel access roads and improve existing access roads in the Project Area. Additionally, Ormat proposes to drill up to two groundwater wells on one or two of the proposed well pads, install above-ground water distribution pipeline, and construct or install the necessary ancillary facilities, including a temporary personnel "camp" for the drill crews. Therefore, a total of 38 wells may be drilled, including 36 geothermal exploration wells and 2 groundwater wells. Ormat would also expand an existing mineral material site to obtain the gravel necessary for the project.

Geothermal exploration activities, including all disturbance necessary for construction and drilling operations, would occur within the Project Area. The Project Area is approximately 160 acres in size and consists of a 10-acre block centered on each proposed well pad location and the existing mineral material site, a 100-foot-wide corridor centered on all proposed access roads, and a 30-foot-wide corridor centered on existing access roads (Figure 2). The specific locations for individual wells would be identified in GDPs submitted separately from this document. However, the specific locations would be limited to areas within the Project Area as identified in the document. The entire Project Area would not be disturbed; instead, only the area where the existing mineral material site is expanded and those areas ultimately developed with a well pad and associated access roads would be disturbed. Drilling operations would be conducted in accordance with BLM and Nevada Division of Minerals (NDOM) regulations and permit requirements.

2.1.1 Project Access

Principal access to the Leach Hot Springs Lease Area is via Grass Valley Road, a county road which extends south from Winnemucca for approximately 25 miles before crossing through the western portions of the Lease Area. While the Lease Area is directly intersected by Grass Valley Road, the Project Area would not be. A combination of existing "two-track" roads and proposed gravel roads would be used to gain access to the Project Area and reach the 12 proposed well pads from Grass Valley Road. Approximately 7,400 feet of existing roads and 10,750 feet of proposed road would be utilized for access to the well pad locations (Figure 2). All existing "two-track" roads and proposed access roads are, or would be, located within the federal geothermal Lease Area and entirely on BLM-managed public land. Road construction and improvement activities are discussed in further detail in Section 2.1.4.

Daily operations would typically require a maximum of 18 vehicle trips per day on Grass Valley Road. This includes 10 trips associated with delivery trucks and 8 trips associated with passenger vehicles used to transport personnel. The trips made by passenger vehicles would generally be between Winnemucca and the Project Area. Trips made by delivery trucks would typically not occur between Winnemucca and the Project Area but would be made within the general vicinity of the Project Area instead. Such trips would be for transporting gravel from an existing and expanded mineral material site in T31N, R38E, section 1, to proposed access roads or for transporting water to the Project Area from a nearby ranch where it may be purchased. If purchased from the ranch, water would be obtained from an existing well in T32N, R38E, NWSW section 36. Approximately 25 additional vehicle trips would be necessary to deliver the production well drill rig to the Project Area. These trips would be made by tractor-trailers and would occur prior to drilling the first production well at the Project Area, should one be scheduled for drilling. Another 25 tractor-trailer trips would be required to remove the drill rig from the site following completion of drilling of the last scheduled production well.

Public access within and through the Project Area would continue to the extent practicable. Generally, public access is provided via existing unimproved two-track roads, some of which would be used by Ormat for access to well pads. Ormat would ensure that project vehicles and equipment are parked and stored in areas that do not block these roads. Personnel would be instructed to yield to public vehicles on project roads during operations. If utilized, polyvinyl chloride (PVC) piping used to transport water to active well pads would be buried beneath road surfaces in locations where a road crossing is necessary. This would prevent blockage of existing roads and maintain public accessibility. Equipment and operations on well pads may create unsafe conditions for the general public. Consequently, to protect the safety of the public, public access onto active well pads would not be permitted. Drill crew personnel are present 24 hours per day at active well pads during the duration of active drilling and would prevent public access onto the drill pad.

2.1.2 Operations Plan

The Proposed Action includes constructing up to 12 well pads capable of accommodating the maximum size necessary for the construction and operation of a production well, 400 feet by 450

feet (4.2 acres). An area of this size is more than sufficient for drilling and operating a temperature gradient well (0.25 acre) or an observation well (2.4 acres), or all three. Assuming all 12 well pads were fully developed with a production well, total well pad disturbance would be approximately 50.4 acres. One of each of the three types of geothermal exploration wells may be drilled on each well pad. However, the drilling of each well type may not necessarily occur on each well pad, no more than one well of each well type would be drilled on any single well pad, and not all well pads may be utilized or developed. Additionally, a maximum total of two non-potable water wells could be drilled to provide water for drilling operations. The water wells would be located on any one of the 12 well pads and would not result in additional surface disturbance.

Ormat would construct approximately 10,750 feet of gravel access roads and improve approximately 7,400 feet of existing "two-track" roads in order to reach the proposed well pad locations (Figure 2). All existing "two-track" roads and proposed access roads are, or would be, located within the federal geothermal Lease Area. Proposed access roads would be constructed with a travel width of 15 feet and 2.5-foot-wide shoulders on both sides, for a total road width of 20 feet. It is estimated that two vehicle pullouts would be needed for adequate vehicle passage on the project access roads. Construction of new access roads would result in approximately 4.94 acres of new surface disturbance, and improvement of existing access roads would result in approximately 4.25 acres of disturbance (Ormat 2010).

Table 1 presents the maximum acreage of the area of disturbance attributed to construction of the well pads and to construction and improvement of the associated access roads. Detailed construction methods for well pads and access roads are provided in Section 2.1.2.1 and 2.1.4, respectively. Detailed drilling procedures are provided in Section 2.1.2.2.

Table 1 Maximum Potential Surface Disturbance Attributed to Proposed Action

Disturbance Type	Length of Access Road (Approximate)	Maximum Number of Well Pad Locations	Aggregate Applied	Maximum Surface Disturbance (Approximate)	Total Disturbed Area (Approximate)
Well Pads	Not Applicable	12	Yes	400 X 450 feet (4.2 acres each)	50.4 acres
New Access Roads	10,750 feet	Not Applicable	Yes	10,750 X 20 feet	4.94 acres
Access Road Pullouts*	Not Applicable	Not Applicable	Yes	150 X 25 feet (0.1 acre each)	0.2 acre (2 pullouts)
Improvements to Existing Roads	7,400 feet	Not Applicable	Yes	7,400 X 25 feet	4.25 acres
Expansion of Existing Mineral Material Site	Not Applicable	Not Applicable	No	660 X 660 feet	10 acres
Maximum Total Disturbance (Approximate):					69.79 acres

*It is estimated that two access road pullouts would be constructed. However, field conditions may warrant additional pullouts. The disturbance necessary for construction of additional pullouts would be subtracted from other disturbance associated with well pads and roads; total impacts would not exceed 69.79 acres.

2.1.2.1 Well Pad Layout and Design

Ormat proposes to construct and conduct drilling on as many as 12 well pads permitted to accommodate the largest designed production well and therefore also accommodate the smaller designed temperature gradient well and observation well, too. Each well pad could be constructed to an approximate size of 400 feet by 450 feet if fully developed and would accommodate the drill rig, reserve pit, and all other support equipment and disturbance necessary for drilling. The exact dimensions and orientations of the well pads would be determined by engineers in the field prior to construction to best match the physical and environmental characteristics of the specific site and to minimize grading. Not all well pad sites may be utilized or developed, and drilling of each well type may not necessarily occur on each well pad. Pad sites would be constructed to the extent necessary to accommodate the well type(s) situated on each. Under no circumstances would a pad site be expanded to a size greater than that prescribed for a production well. The well pad required for each of the three types of geothermal exploration wells is described in detail below. The approximate maximum sizes of well pads and reserve pits per well type are provided in Table 2.

Table 2 Well Pad and Reserve Pit Size per Exploratory Well Type

Exploratory Well Type	Maximum Well Pad Size (Approximate)*	Maximum Surface Disturbance per Pad (Approximate)*	Maximum Reserve Pit Size (Approximate)*	Maximum Reserve Pit Capacity (Approximate)*
Temperature Gradient Well	100 feet X 100 feet	0.25 acre	12 feet X 4 feet X 4 feet	192 cubic feet (1,436 gallons)
Observation Well	300 feet X 350 feet	2.41 acres	15 feet X 100 feet X 10 feet	15,000 cubic feet (112,200 gallons)
Production Well	400 feet X 450 feet	4.20 acres	75 feet X 200 feet X 10 feet	150,000 cubic feet (1,122,000 gallons)

*The exact orientation and configuration would be determined by engineers before construction. The maximum reserve pit size does not include perimeter berm measuring approximately 4 feet in width and 2 feet in height.

Temperature gradient well pads

Generally, the construction of a temperature gradient well pad requires very little vegetation clearing or earth-moving activities. A truck-mounted drilling rig similar to those used for drilling domestic water wells would be used to drill this type of well. This type of drilling rig can often be moved onto a site, leveled, and prepared for operations with very little grading of the site. However, the terrain and conditions specific to individual sites may require some grading and leveling of the well pad before drilling can be performed safely and effectively. Therefore, depending on the terrain and site conditions specific to each proposed well pad location in the Project Area, individual well pads could be graded, leveled, and constructed up to the maximum size of approximately 100 feet by 100 feet (Figure 4). Should Ormat decide to drill an observation well or production well on any site where a temperature gradient well was drilled, the existing pad would be incorporated into the larger pad and expanded as needed (Ormat 2010).

Some individual temperature gradient well pads may require the construction of a single, small reserve pit. The reserve pits would be constructed to a maximum size of 12 feet in length and 4 feet in width, and excavated to a maximum depth of 4 feet below ground surface. A berm measuring approximately 4 feet in width and 2 feet in height would be constructed around the upper perimeter of the reserve pits. Material used to construct the berm would consist primarily of material excavated from the construction of the reserve pit where the berm is located. Additional material from construction of the well pad where the berm and pit are located would also be used. The reserve pits and the berms would be compacted during construction. Settled bentonite clay originating from the drilling mud would accumulate on the bottom of the pit and act as an unconsolidated clay liner that minimizes percolation.

Reserve pits would be constructed to contain all anticipated drilling muds, cuttings, and fluids, as well as any natural precipitation falling within the pit, while maintaining a minimum 2 feet of freeboard. If constructed to the maximum size described above, a single reserve pit would have

the capacity to contain approximately 192 cubic feet, or 1,436 gallons, while providing for a minimum 2 feet of freeboard. The pit, equipment, and disturbance necessary for the development of the exploration well would not exceed the limits of the well pad.

Observation well pads and production well pads

Well pads accommodating an observation well could be graded, leveled, and constructed to a size of 300 feet by 350 feet (Figure 5). Disturbance may be less depending on conditions specific to a particular well pad location. Production well pads could be constructed to a maximum size of approximately 400 feet by 450 feet (Figure 6). The approximate maximum pad sizes and the associated surface disturbance are provided in Table 2. The well pad would accommodate the drilling rig, reserve pit, and support equipment and vehicles necessary during drilling. The exact orientation and configuration of the well pads would be determined by engineers before construction.

The proposed well pad locations would be located on relatively flat topography (2 to 8 percent slopes) that gently slopes west, although some clearing and grading (cut and fill) may be necessary at individual pad sites. Any fill slopes that may be constructed as a part of well pad grading would be no greater than 2 horizontal to 1 vertical and would be compacted and maintained to minimize erosion and provide slope stability. Each well pad would be graded to prevent the movement of stormwater off the constructed site. The well pads would be constructed to avoid ephemeral washes to the extent practicable. In addition, the pads would be designed to divert any upslope sheet wash or water in ephemeral washes around and away from the drill pad. Storm water runoff from undisturbed areas around the constructed drill pads would be directed into ditches surrounding the well pad and back onto undisturbed ground consistent with BMPs for storm water. Only well pads scheduled to be drilled would be cleared and graded. Surface disturbance would be kept to a minimum, to the extent necessary to accommodate drilling and operation of the scheduled well type.

After the well pad area has been graded and spoils from the well pad reserve pit excavation have been laid down for leveling, an average of 8 inches of gravel would be placed over the areas where the drilling work would be conducted. The drilling rig footprint would require additional stabilizing for heavier equipment and would receive an additional 10 inches (for a total average of 18 inches) of compacted aggregate.

A single reserve pit would be constructed on each well pad. Consistent with the Gold Book (BLM 2007), reserve pits would be constructed to contain all anticipated drilling muds, cuttings, and fluids, as well as any natural precipitation falling within the pit, while maintaining a minimum 2 feet of freeboard. The size of the reserve pit would depend on whether an observation well or a production well was scheduled for drilling on the pad. A reserve pit constructed for drilling an observation well would be constructed to a maximum size of approximately 100 feet in length and 15 feet in width and excavated to approximately 10 feet below ground surface. A reserve pit constructed for drilling a production well would be excavated to the same approximate depth but would be constructed to a maximum length of 200

feet and width of 75 feet (Table 2). A berm measuring approximately 4 feet in width and 2 feet in height would be constructed around the upper perimeter of the reserve pits. Material used to construct the berm would consist primarily of material excavated from the construction of the reserve pit where the berm would be located. The reserve pits and the berms would be compacted during construction. Settled bentonite clay originating from the drilling mud would accumulate on the bottom of the pit and act as an unconsolidated clay liner that minimizes percolation. Reserve pits would be constructed and fenced in accordance with the BMPs identified in the Gold Book (BLM 2007).

Constructed to the sizes described above, a reserve pit for drilling an observation well would have the capacity to contain approximately 15,000 cubic feet, or 112,200 gallons, while providing for a minimum 2 feet of freeboard. A reserve pit for drilling a production well would have the capacity to contain approximately 150,000 cubic feet, or 1,122,000 gallons, while providing for a minimum 2 feet of freeboard. The actual excavation depth of individual reserve pits would be determined based on the depth to groundwater at that location to ensure the bottom of the reserve pit is above the standing water level. Consequently, to maintain adequate storage capacity, the length and width of a reserve pit may be field adjusted should it be necessary that the depth be shallower than 10 feet. The pit, equipment, and disturbance necessary for the development of the exploration well would not exceed the limits of the well pad.

Upon completion of the drilling operations, clean-out and flow tests would be performed on the wells. Flow testing would typically run for an average of three days (24 hours per day) for each well, but the duration may vary depending on well characteristics. During these tests the flow would be routed to the reserve pit (Ormat 2010).

2.1.2.2 Geothermal Well Drilling Plan

Ormat proposes to drill as many as 12 temperature gradient wells, 12 observation wells, and 12 production wells. Typically, only one well would be actively drilled at any given time, but Ormat may elect to drill up to two wells simultaneously, which would require two drilling rigs be present. All wells regardless of well type would be drilled with air or a non-toxic, temperature-stable drilling mud composed of a bentonite clay-water or clay-polymer-water mixture. The drilling mud is used to lubricate and cool the drill bit, bring the rock cuttings to the surface for discharge into the mud tank, and prevent loss of drilling fluids into the rock. The drilling rig's mud system would be supplemented with additional drilling mud as needed to maintain the required quantities of the drilling mud (Ormat 2010). Additives would be used as needed to prevent corrosion, increase mud weight, and prevent mud loss, in conformance with the submitted drilling mud program. The materials and additives commonly used during well drilling are provided in Table 3. The concentrations of additives used in drilling mud would vary depending on well conditions such as depth, pH levels, formation, mud weight, and so on.

All materials and additives would be stored on active well pads or on equipment during drilling. Material would be stored away from the perimeter of well pads to prevent materials from leaving the pad in the event of an accidental spill.

Secondary containment structures would be provided for all chemical and petroleum/oil storage areas during drilling operations.

Table 3 Common Materials and Additives Used During Drilling

Product	Typical Quantity Used	Storage
Drilling mud gel (bentonite clay)	334,000 pounds	100-pound sacks on pallets
Salt (NaCl)	134,000 pounds	50-pound sacks
Barite (BaSO4)	20,000 pounds	50-pound sacks
Tannathin (lignite)	4,200 pounds	50-pound sacks
Lime (calcium hydroxide)	3,400 pounds	50-pound sacks
Caustic soda (sodium hydroxide)	1,700 pounds	50-pound sacks
Soda ash (sodium bicarbonate)	1,700 pounds	50-pound sacks
Diesel fuel	54,000 gallons	6,000-gallon tank
Lubricants (motor oil, compressor oil)	1,700 gallons	55-gallon drums
Hydraulic fluid	400 gallons	55-gallon drums
Anti-freeze (ethylene glycol)	220 gallons	55-gallon drums
Liquid polymer emulsion (partially hydrolyzed polyacrylamide / polyacrylate (PHPA) copolymer)	170 gallons	5-gallon buckets
Defoamer	170 gallons	5-gallon buckets
Water loss control agent (Drispac)	20,000 pounds	50-pound sacks
Lost circulation fibers (vegetable and polymer fibers)	100,000 pounds	50-pound sacks

Temperature gradient wells

Each temperature gradient well would be drilled and completed to a nominal depth of approximately 1,000 feet (Figure 4) using a truck-mounted rotary drilling rig. The drilling rig would be equipped with diesel engines, fuel and drilling mud storage tanks, mud pumps, and other typical auxiliary equipment. During drilling the top of the drill rig derrick would be from 30 to 50 feet above the ground surface, depending on the rig used. An average of four to six small trucks/service vehicles/worker vehicles could be driven to the active well site each day throughout the typical eight-day drilling process. Difficulties encountered during the drilling process, including the need to re-drill the hole, could as much as double the time required to successfully complete each temperature gradient well. Drilling would be conducted 24 hours per day, 7 days per week by a crew of up to three workers. Other support personnel (geologists, suppliers, etc.) could bring the total number of workers on-site at one time to six or more persons (Ormat 2010).

Observation wells

Each observation well would be drilled using a truck-mounted rig equipped with diesel engines, fuel and drilling mud storage tanks, mud pumps, and other typical auxiliary equipment. During drilling the top of the drill rig derrick would be from 30 to 70 feet above the ground surface, depending on the rig used. An average of four to six small trucks/service vehicles/worker vehicles would be driven to the active observation well site each day throughout the typical 15-

day drilling process. Difficulties encountered during the drilling process, including the need to re-drill the observation well, could as much as double the time required to successfully complete each observation well. Drilling would be conducted 24 hours per day, 7 days per week by a crew of up to three workers. Other support personnel (geologists, suppliers, etc.) could bring the total number of workers on-site at one time to as many as ten or more persons.

Each observation well would be drilled or cored and completed to a nominal depth of approximately 3,000 feet, or the depth selected by the project geologist (Figure 5). The lengths of the surface and production casings in each well would be lengthened or shortened as needed to accommodate a well depth deeper or shallower than 3,000 feet. Once drilled or cored to the final depth, the drilling mud in the well would be circulated out of the well bore using water. The water and/or geothermal fluid in the well would be bailed from the well by either lifting with a mechanical bailer or by lifting with air pumped into the well bore so that a clean sample of the geothermal fluid in the reservoir could be obtained for chemical analysis. Alternatively, if the well is capable of flowing, the well may be flowed to the surface through a steam separator/muffler to separate the steam (which is discharged into the air) from the geothermal water (which is discharged into steel tanks or the reserve pit) so that the geothermal fluid can be sampled (Ormat 2010).

Following the cementing of the surface casing, "blowout" prevention equipment (BOPE) would be installed. The BOPE, which is typically inspected and approved by the BLM and/or the NDOM, as applicable, would be installed, tested, and ready for use while drilling the observation well to ensure that any geothermal fluids encountered do not flow uncontrolled to the surface.

Production Wells

Each production well would be drilled with a rotary drill rig similar to those used to drill oil and gas wells. During drilling, the top of the drill rig mast could be as much as 170 feet above the ground surface. The typical drill rig and associated support equipment (rig floor and stands; draw works; mast; drill pipe; trailers; mud, fuel and water tanks; diesel generators; air compressors; etc.) would be brought to the prepared well pad on 25 or more large tractor-trailer trucks. Additional equipment and supplies would be brought to the drill site during ongoing drilling and testing operations. As many as ten or more tractor-trailer truck trips would be generated on the busiest day, although on average about two to three large tractor-trailer trucks (delivering drilling supplies and equipment) and about eight small trucks/service vehicles/worker vehicles would be driven to an active well site each day throughout the typical 45-day drilling process. Difficulties encountered during the drilling process, including the need to work over or to re-drill the hole, could double the time necessary to successfully complete a production well. Drilling would be conducted 24 hours per day, 7 days per week by a crew of nine to ten workers. During short periods, the number of workers on-site during drilling would be as high as 18.

The production wells would each be drilled and cased to a design depth of approximately 6,000 feet, or the depth selected by the project geologist (Figure 6). The surface and production casings in each well would be lengthened or shortened as needed to accommodate a well depth deeper or

shallower than 6,000 feet. The BOPE would be utilized while drilling below the surface casing. During drilling operations, a minimum of 10,000 gallons of cool water and 12,000 pounds of inert, non-toxic barite (barium sulfate) would likely be stored at each well site for use in preventing uncontrolled well flow, as necessary.

The well would be drilled using non-toxic, temperature-stable drilling mud composed of a bentonite clay-water or polymer-water mix for all wells. Variable concentrations of additives would be added to the drilling mud as needed to prevent corrosion, increase mud weight, and prevent mud loss. Some of the mud additives may be hazardous substances, but they would only be used in low concentrations that would not render the drilling mud toxic or hazardous. The additives commonly used in drilling mud are provided in Table 3. In the event that very low pressure areas are encountered, compressed air may be added to the drilling mud, or used instead of drilling mud, to reduce the weight of the drilling fluids in the hole and assist in carrying the cuttings to the surface. The air, any drilling mud, rock cuttings, and any reservoir fluids brought to the surface would be diverted through a separator/muffler to separate and discharge the air and water vapor to the air and the drilling mud and cuttings to the reserve pit.

Each production well may need to be re-worked or re-drilled if mechanical or other problems are encountered while drilling or setting casing which prevent proper completion of the well in the targeted geothermal reservoir or if the well does not exhibit the anticipated permeability, productivity, or injectivity. Depending on the circumstances encountered, working over a well may consist of lifting the fluid in the well column with air or gas or stimulating the formation using dilute acid or rock-fracturing techniques. Well re-drilling may consist of re-entering and re-drilling the existing well, re-entering the existing well and drilling and casing a new well bore, or sliding the rig over a few feet on the same well pad and drilling a new well through a new casing.

Once a slotted liner has been set in the bottom of the well, and while the drill rig is still over the well, the residual drilling mud and cuttings would be flowed from the well and discharged to the reserve pit. This may be followed by one or more short-term flow test(s), each lasting from two to four hours and also conducted while the drill rig is over the well. Each test would consist of flowing the production well into portable steel tanks brought onto the well site while monitoring geothermal fluid temperatures, pressures, flow rates, chemistry, and other parameters. An "injectivity" test may also be conducted by pumping the produced geothermal fluid from the steel tanks back into the well and the geothermal reservoir. The drill rig would likely be moved from the well site following completion of these short-term tests.

Well stimulation operations to enhance the flow of geothermal reservoir fluid into the well bore may be necessary. These operations would involve placing a dilute mixture of hydrochloric (muriatic) acid down the well. The amount of dilute acid placed in the well bore is dependent upon the mineral being dissolved and can vary from 10,000 to 50,000 gallons or more. Concentrated hydrochloric acid (35 percent) would be trucked to the site per occurrence and mixed on-site with water by experienced contractors (hydrochloric acid would not be stored on-

site). The dilute acid mixture would be placed in the cased well bore, followed by water to push the mixture into the geothermal reservoir to dissolve the minerals. After dissolving the minerals in the geothermal reservoir, the water and spent acids would be circulated back through the well to the surface, where they would be tested, neutralized if necessary (using sodium hydroxide, crushed limestone, or marble), and discharged to the well pad reserve pit.

One or more long-term flow test(s) of each production well drilled would likely be conducted following the short-term flow test(s) to more accurately determine long-term well and geothermal reservoir productivity. The long-term flow test(s), each lasting approximately five days or more, would be conducted by either pumping the geothermal fluids from the well through on-site test equipment closed to the atmosphere (using a line shaft turbine pump or electric submersible pump) or allowing the well to flow naturally to the surface, where the produced steam and non-condensable gases including any hydrogen sulfide (H_2S), separated from the residual geothermal fluid, would be discharged into the atmosphere. In either case, a surface booster pump would then pump the residual produced geothermal water/fluid through a temporary 8- to 10-inch-diameter pipeline to either inject the fluid into one of the other geothermal wells drilled within the Project Area or to the reserve pit on another well pad. The temporary pipeline would either be laid "cross-country" or on the surface on the disturbed shoulders of the access roads connecting the geothermal production wells (as required, roads would be crossed by trenching and burying the temporary pipe in the trench). The on-site test equipment would include standard flow metering, recording, and sampling apparatus (Ormat 2010).

2.1.2.3 Ancillary Facilities and Equipment

During drilling operations, a temporary "camp" would be provided for the drill crew/workers remaining on-site for the duration of drilling. The camp would be located on the well pad that is actively being drilled or on a previously constructed drill pad. Because the camp would be limited to the area within the limits of the active well pad, no additional grading would be required to create the camp. During drilling of any one of the three well types, members of the drilling crew may elect to stay on-site or commute, depending on their place of residency and transportation. The personnel permitted to remain on-site would be limited to members of the active workforce.

The camp would consist of self-contained trailers, motor homes, and/or prefabricated modules used for temporary living quarters. The drilling supervisor and mud logger would typically sleep in a self-contained trailer or motor home on the active drill site while the well is being drilled. The drilling contractor may also elect to have the drilling crew stay at the drilling site during the drilling operations to reduce the substantial hours and miles otherwise required for the crew to commute daily. If the crew would remain at the drilling site during the drilling operation, the drilling contractor would provide self-contained temporary quarters (sleeping area, galley, water tank, and septic tank) or portable trailers or motor homes which would be placed on one of the well pads not actively being drilled. Typically, a production well would include a total of up to four trailers, motor homes, and/or prefabricated modules. Additionally, a separate trailer would

be located on each active well pad to provide office space. The components would be brought to the site by trailer along the existing Grass Valley Road and the proposed access roads. The non-potable water supply for the camp would be supplied from portable water tanks. Drinking water would be bottled water brought from off-site. A chemical toilet would be provided at each active well site, and the temporary living quarters may also contain individual toilet facilities. All septic and gray water holding tanks would be located above ground and would be cleaned/cleared by a local service company. No septic tanks would be buried, and all tanks would be removed from the Project Area upon completion of the project. Electricity would be provided by portable generators. The use of all ancillary facilities and equipment would be restricted to the active workforce, and the active workforce would be the only personnel members permitted to stay on-site. Any trash generated would be contained on-site in supply bins (i.e., dumpsters) and hauled by a local commercial disposal company, as needed, to an approved landfill. No trash would be buried on-site. Use of the project facilities would be restricted to drill crew personnel.

Communication among field operations, Ormat offices, the BLM offices, and NDOM offices would be maintained with the use of radio and satellite telephones, and cellular phones when possible. Support facilities and equipment would be located on the same well pad as the camp utilizing such facilities and equipment.

Additional components and equipment that may be used during drilling activities include the following:

- As many as 12 reserve pits (one at each well pad site) with a maximum individual potential storage capacity of 150,000 cubic feet.
- Chemical toilets at each active well pad site.
- Water storage tanks at each active well pad site capable of containing a combined volume of at least 10,000 gallons.
- Two groundwater wells located on one or two well pad sites (discussed in detail in Section 2.1.5).
- Pipe racks stored at each active well pad site.
- Fuel storage area with secondary containment located at each active well pad site.
- Mud storage, mud tank, and mud logger at each active well pad site.
- A diesel generator.
- Air compressors.
- Drilling crew/worker vehicles (six to eight typical ¾- to 1-ton pickup trucks).
- Up to two flatbed trucks or flatbed boom trucks.
- Up to two backhoes.
- One D8 bulldozer.
- One compactor.
- One crane.
- Up to two front-end loaders.
- One road grader.

- One water truck.
- Up to two belly dump trucks.
- One or two truck-mounted drill rigs.
- One production size drill rig (would require up to 40 semi-truck loads to deliver).
- Two mobile light plants.

All lighting resulting from implementation of the Proposed Action would be associated with the trailers in the personnel camp on drill equipment and on drill masts as required by FAA regulations.

2.1.3 Actions Proposed on Private Lands

Ormat may obtain water from a nearby ranch, from an existing well in T32N, R38E, NWSW section 36. Water use is discussed in section 2.1.5.

2.1.4 Road Construction Activities

Approximately 7,400 feet of existing "two-track" roads exist within the Project Area and would be utilized for gaining access to the well pad locations within the Project Area. Most of the existing "two-track" roads, although visibly existent, would require improvement (i.e., grading, widening, and blading) for vehicular travel. Road widths and improvement activities would be restricted to an approximately 20-foot-wide corridor centered on the existing road. Should all 7,400 feet of existing road be utilized for access, improvement activities would result in approximately 4.25 acres of disturbance.

Accessing the Project Area on the east side of Grass Valley Road would require crossing through the Grass Valley Road Fence. This fence (shown on Figure 3) is a Range Improvement Project that assists in managing individual livestock operations within the Clear Creek (east) and Dolly Hayden (west) Allotments. There are existing cattleguards and/or gates on some of the access roads, and additional modifications of this fence may be necessary to access the Project Area. Ormat would either improve the existing fence by installing a gate or would install a cattleguard. All modifications would be coordinated with the BLM.

Where access roads do not exist, new gravel access roads would be constructed to each of the well pads as necessary and would remain within the limits of the proposed Project Area. Proposed access roads would be constructed with a travel width of 15 feet and 2.5-foot-wide shoulders on both sides, for a total width of 20 feet. Aggregate would be applied to the entire road width at an average base depth of 6 inches. Drilling would require vehicle pullouts to be constructed at a width of 25 feet and length of 150 feet. It is estimated that two vehicle pullouts would be necessary for adequate vehicle passage on project access roads. However, field conditions may warrant additional pullouts. The disturbance necessary for construction of additional pullouts would be subtracted from other disturbance associated with well pads and roads; total impacts would not exceed 69.79 acres. The exact location of proposed pullouts would be field verified and submitted to the BLM for approval prior to construction. The roads

would be graded to follow existing topography and minimize cut-and-fill requirements. Rolling dips would be provided along new access roads in areas where low spots or existing ditches are crossed. The rolling dips would be designed to accommodate flows from at least a 25-year storm event. Exact locations of rolling dips have yet to be determined but would be provided to the BLM once the final design is complete. Culverts may be used wherever rolling dips are not feasible. Culvert installation would follow BLM design criteria and specifications applicable for temporary roads. Under the Proposed Action, up to approximately 10,750 feet of new access road could be constructed, resulting in approximately 4.94 acres of disturbance.

A dozer and/or grader would be used to construct proposed access roads and improve existing roads. Road designs and improvements, including road cross section and crowns, rolling dip designs and placement, and road plans and profiles would be executed in accordance with Gold Book standards (BLM 2007).

Reclamation would include grading to reshape preconstruction contours. Reclaimed areas would be planted with the BLM-specified seed mix presented in Table 5. Access roads in existence prior to commencement of the project would not be fully reclaimed; these roads would be returned as close as possible to their original condition prior to commencement of the project. The outer edges of the roads would be ripped and seeded, leaving only a "two-track" width as the driving surface. Detailed specifications regarding the abandonment and reclamation of access roads are discussed in Section 2.1.8.

2.1.5 Water Required

Water would be needed for drilling operations, construction and compaction of roads, pads, and reserve pits, and dust control. Project-related water would be obtained from no more than two non-potable groundwater wells. Each well would be temporary and located on any one of the 12 pad sites; therefore, no additional surface disturbance would be associated with the drilling of the groundwater well(s). The wells would be permitted under a geothermal waiver by NDWR and approved by the BLM. Each well would be drilled by a licensed water well driller to a productive interval of sands, gravels, or fractures (estimated at approximately 500 feet). A submersible electric pump on a 4-inch column would then be placed below the productive interval in each well. The wells would be constructed, plugged, and abandoned in accordance with Nevada Administrative Code (NAC) Chapter 534.

Water required for observation and production well drilling, with approval from NDWR, could range up to 30,000 gallons per day. Water requirements for temperature gradient well drilling, grading, construction, and dust control would average approximately 10,000 gallons per day. One or more portable water tanks capable of containing a combined total of at least 10,000 gallons, but not more than 60,000 gallons, would be maintained at each well site during drilling operations.

Water would be transported to the geothermal well locations either by aboveground, 8-inch, black PVC piping or via truck from the wells. All piping would follow the proposed and existing

access routes in areas that would be environmentally cleared and approved by the BLM. All storage containers would be located on the proposed well pad.

As an alternative, water needed for construction and drilling operations could also be purchased and trucked from an existing well owned by A&B Paradise Enterprises, LLC. The existing well is located on private lands known as the "Hot Springs Ranch" near Leach Hot Springs in T32N, R38E, NWSW section 36. Grass Valley Road would be the route used to transport water between the Project Area and the well (Figure 7). Water would be transported from Grass Valley Road via proposed access roads and existing roads on the Hot Springs Ranch. Typical operations would require four water truck deliveries per day if purchased off-site and delivered via truck. Should Ormat acquire water through this alternative, Ormat would file for a temporary permit from the NDWR. The temporary permit would allow some portion of the existing water rights at the source to be temporarily allocated for geothermal exploration at the Project Area. The permit would be obtained prior to acquisition of the water. Prior to water utilization, Ormat would provide BLM with documentation from any water right holders that an agreement has been reached about water use. Ormat would utilize a small crane to place a pump in the well and then back trucks to the well to pump water. No new surface disturbance would be required for purchase of water from A&B Paradise Enterprises, LLC.

2.1.6 Aggregate Material Required

Only well pads scheduled to be drilled would be cleared. Clearing would include removal of organic material, stumps, brush, and slash. Topsoil would be salvaged during the construction of all pads and access roads, and stockpiled on the pads for use during subsequent reclamation of the disturbed areas. The well pads would be graded so that cut and fill requirements would be balanced to minimize the need for off-site fill material. If additional fill material is necessary at a particular well pad, the material would be obtained from the excavation of the reserve pit at that well pad. The excavated material would also be used to construct the perimeter berm around the reserve pit; therefore, any excavated material not used for construction of the berm would be available for use as fill on the well pad. Approximately 15,000 cubic feet of material would be excavated at a single reserve pit on a well pad constructed for drilling an observation well. Approximately 1,360 cubic feet would be required for construction of the reserve pit berm, leaving about 13,640 cubic feet available for use as fill on the well pad. Excavation of a reserve pit for drilling a production well would produce approximately 150,000 cubic feet of material. Construction of the perimeter berm would consume approximately 3,120 cubic feet of this material, leaving about 146,880 cubic feet of material available for use as fill on the well pad.

Approximately 192 cubic feet of material would be removed from a reserve pit excavated for drilling a temperature gradient well. The perimeter berm would require approximately 270 cubic feet of material to construct, and therefore there would be no available fill material resulting from excavation of the reserve pit.

No additional fill material would be necessary at well pads constructed for drilling a temperature gradient well, however, as a temperature gradient well pad would require very little if any grading.

Each well pad would be covered with up to 8 inches of aggregate (gravel). Gravel would be applied to the access roads, as necessary, at an average depth of 6 inches to create an all-weather surface. Total aggregate required if all well pads were to be drilled as production wells would be approximately 48,890 cubic yards, as listed below in Table 4. Approximately 1,418 cubic yards of gravel would be placed on well pads beneath the drill rig to provide extra support. If all proposed access roads were constructed, approximately 3,982 cubic yards of material would be required. Improvements to existing roads would require an additional 2,740 cubic yards, and gravel and access road pullouts would require approximately 70 cubic yards of material. The total maximum volume of gravel needed for the Proposed Action is estimated at 57,100 cubic yards (Ormat 2010). The gravel needs specific to well pads, access roads, pullouts, and drill rig support are provided in Table 4.

Table 4 Project Aggregate Requirements

Project Component	Aggregate Required (cubic yards)
Well pads (12 production well pads)	48,890
Drill rig support (on all 12 well pads)	1,418
New access roads	3,982
Improvement of existing roads	2,740
Access road pullouts	70
Total aggregate required	57,100

Well pad and road-building gravel would be obtained from an existing and partially developed mineral material site that is located in the southwest area of the Lease Area, specifically within T31N, R38E, section 1, lots 1 and 2 (Figure 2). The existing site is authorized under Free Use Permit BLM Serial Number NVN-081087 held by the BLM Engineering Operations crew (Figure 3). Ormat would enter a mineral sale contract with the BLM in accordance with mineral material regulations prior to extracting or utilizing material from the mineral material site. Utilization of the mineral material site would require Ormat to expand the mineral material site to ensure it can produce enough aggregate to fulfill the needs of the project but also the needs of Pershing County. Ormat would expand the site incrementally as the demand for gravel dictates but would not expand it beyond an area of approximately 10 acres (approximately 660 feet by 660 feet), as shown on Figure 3. The gravel site is accessible from an existing road and would not require improvements or construction of any existing or new roads. Operation and expansion of the mineral material site would require two persons, a front-end loader, a separation screen, and up to two dump trucks for transporting material. The four well pads that are proposed in the northwest portion of the Lease Area would require dump trucks to travel along Grass Valley Road for approximately 1.5 miles to reach the mineral material site. The other proposed well pad locations would require only crossing of Grass Valley Road.

2.1.7 Work Force and Schedule

Ormat proposes to initiate the Proposed Action immediately following BLM approval and issuance of required local, state, and federal permits and approvals for the project, most likely during summer 2011. The project activities would be performed over the next one to five years, depending on the types and quantity of wells drilled. After well operations have ceased or the geothermal lease is relinquished to BLM, reclamation activities would be performed as described in Section 2.1.8.

Typically, drilling a temperature gradient well or observation well requires a drill crew of 3 people. Drilling a production well generally requires a larger drill crew of about 10 people, with occasional periods requiring up to 18 people. Additional personnel may periodically visit active drill sites, including support geologists, suppliers, and agency officials. Drilling crews would operate drill rigs 7 days a week, 24 hours a day regardless of the well type actively being drilled. Approximately 8 days would be required to complete the drilling of a temperature gradient well, 15 days would be required for an observation well, and approximately 45 days would be required for a production well. Difficulties encountered during the drilling process, including the need to work over or to re-drill the well, could double the time necessary to successfully complete any one of the three well types.

2.1.8 Site Reclamation

If Ormat determines that a well has commercial viability, well operations would likely be suspended pending application for, and receipt of, regulatory approvals to place the well and associated access roads and other components required to operate the well into commercial service. The well would likely be monitored and exploration activities would continue in accordance with these plans while the application is processed. Interim reclamation activities would be implemented as described below. Ormat would routinely assess the usefulness of wells, and if Ormat were to judge certain wells to be unsuitable for commercial use or monitoring, upon BLM approval, the wells would be plugged and abandoned in conformance with the procedures for final reclamation outlined below.

Interim and final reclamation activities proposed in this section are consistent with BLM and Nevada State Regulatory requirements, including recommendations provided in the Gold Book (BLM 2007). The Operations Plan submitted to BLM on May 17, 2010, and approved on June 4, 2010, has additional detail for interim and final reclamation procedures.

2.1.8.1 Interim Reclamation

Disturbed areas not needed for active support of operations would undergo interim reclamation as soon as practical. Any liquids in the reserve pits would be evaporated. Solids remaining in the pit, which typically consist of non-hazardous, non-toxic drilling mud and rock cuttings, would be sampled for pH, metals, and total petroleum hydrocarbons for confirmation the material is non-hazardous and non-toxic. If analysis determines the material to be non-hazardous and non-toxic, the solids would then be mixed with excavated soil and buried under backfill in the reserve pit.

Any material that is determined to be hazardous or toxic would be excavated and disposed of at an approved landfill.

During the construction and drilling process, topsoil would be salvaged and stockpiled for use during reclamation. Following completion of exploratory well testing, drilling and testing equipment would be removed from the site. With the exception of an area required to access maintained wellheads, cut and fill slopes would be graded to a final or intermediate contour that blends with the surrounding topography, and erosion control measures would be implemented. Ormat would maintain healthy, biologically active topsoil and minimize habitat and forage loss during the life of the wells by stockpiling and/or spreading any extra salvageable topsoil over the area of interim reclamation whenever possible. The area would be reseeded to within a few feet of the area required for wellhead access.

Surface facilities remaining on-site for observation wells would consist of a wellhead and potential monitoring equipment and the access roads necessary to access the observation wells. The temporary new access roads created for the project would be reclaimed by removing gravel, grading to achieve preconstruction contours, and then planting with the BLM-provided seed mix presented in Table 5 once they are deemed not necessary for access. Following completion of testing activities, the well would be chained and locked, and a fence constructed around the perimeter of the well in accordance with BLM specifications for temporary fencing. The fence would be approximately 4 feet tall and enclose a roughly 15-foot by 15-foot area centered on the wellhead. The fence would be a typical three-strand barbed-wire fence, with a smooth-wire bottom strand, with wooden posts. Additional temporary construction safety fencing may also be set up during construction activities. Fencing would not be constructed in drainages. Wells could be shut-in with a mineral oil cap as applicable. Pressure and temperature sensors could be installed in the well at fixed depths to monitor any changes in these parameters over time. The well pads and access roads would be left in place and subject to regular inspection and maintenance by Ormat personnel, until such time as the well is deemed by Ormat to be unnecessary or the geothermal lease is relinquished to BLM. Final reclamation activities for those sites would then be engaged.

Temporary groundwater wells would either be abandoned following completion of exploration activities in accordance with Nevada State Regulatory requirements or if exploratory data provides evidence of a productive reservoir, wells could be converted to permanent use for future geothermal energy production. If the well is suitable for long-term use, Ormat would obtain the necessary permits from the Nevada State Engineer prior to such use.

2.1.8.2 Final Reclamation

After all well operations have ceased or the geothermal leases are relinquished back to the BLM, Ormat would reclaim remaining disturbance related to the proposed project. Ormat would restore all disturbed areas to preconstruction contours or to surrounding landforms where restoration of preconstruction contours is not feasible. Disturbed areas would be reseeded with the BLM-specified seed mix presented in Table 5, and invasive, non-native plants and noxious weeds

would be controlled in accordance with BLM guidelines and lease stipulations. Ormat would implement erosion-control measures and BMPs during reclamation. Project-related equipment and machinery would be decommissioned and, where possible, reused or sold as salvage. Equipment with no resale value would be sold or given as scrap. The BLM may provide additional reclamation guidance or direction during reclamation to improve success.

Ormat would plug and abandon all wells compliant with BLM and Nevada State Regulatory regulations. A detailed plan for well plugging and abandonment would be addressed in Ormat's Application to Drill (Form 3260-3) and Drilling Program. Following the abandonment of wells, gravel surface material would be removed from well pads and the well pads would be disked and graded to loosen compacted soils and reshaped to preconstruction grades as close as possible. The reserve pits would be backfilled after liquids in them are evaporated and tests indicate pit solids are non-hazardous and non-toxic. Well pads would be surfaced with stockpiled topsoil where available and planted with a seed mix specified by BLM and free of noxious weeds at the time of reclamation. Unless BLM requests otherwise, all roads constructed for project access would be reclaimed by grading to restore preconstruction contours and then planted with the BLM-specified seed mix presented in Table 5. Gravel applied to roads and drill pads during construction and operation would be removed during reclamation. Pershing County has agreed to allow Ormat to redistribute this gravel on Grass Valley Road. Access roads in existence prior to commencement of the project would not be reclaimed; these roads would be returned as close as possible to their original condition prior to commencement of the project. The outer edges of the roads would be ripped and seeded, leaving only a "two-track" width as the driving surface.

Table 5 Reclamation Seed Mix

Species	Pure Live Seed (PLS) Pounds/Acre	Bulk Pounds/Acre	PLS/square foot
Fourwing saltbush*	3.00	5.00	4
Shadscale*	3.00	5.00	4
Indian ricegrass*	1.00	1.25	4
Siberian crested wheatgrass	2.50	3.00	10
Wyoming big sagebrush*	0.20	2.00	14
Totals	9.70	16.25	36

* Native species

2.2 ENVIRONMENTAL PROTECTION MEASURES

Ormat would comply with the stipulations attached to federal geothermal leases N-74276, N-76458, and N-85717 (Appendix A) and listed below. This section also includes the environmental protection measures that Ormat would implement voluntarily during construction and operation of the Proposed Action (Ormat 2010). For purposes of this EA, environmental protection measures include standard operating procedures.

Prevention and Control of Fires

Ormat would implement the following fire contingency plan in the event of any fire started on or near the Project Area:

- Any small fires which occur around the well pad during drilling and/or testing operations should be able to be controlled by rig personnel utilizing on-site firefighting equipment.
- The BLM Winnemucca District Office (775.623.3444 or 800.535.6076) would be notified immediately of any wildland fire, even if the available personnel can handle the situation or the fire poses no threat to the surrounding area.
- A roster of emergency phone numbers would be available at the project site so that the appropriate firefighting agency can be contacted in case of a fire.
- All vehicles would carry at a minimum, a shovel, 5 gallons of water (preferably in a backpack pump), and a conventional fire extinguisher.
- Adequate fire-fighting equipment (a shovel, a Pulaski, standard fire extinguisher(s), and an ample water supply) would be kept readily available at each active drill site. Water that is used for construction and dust control would be available for fire suppression.
- Vehicle catalytic converters (on vehicles that enter and leave the drill site on a regular basis) would be inspected often and cleaned of all flammable debris.
- All cutting/welding torch use, electric-arc welding, and grinding operations would be conducted in an area free, or mostly free, from vegetation. An ample water supply and shovel would be on hand to extinguish any fires created from sparks. At least one person in addition to the cutter/welder/grinder would be at the work site to promptly detect fires created by sparks.
- Personnel would be responsible for being aware of and complying with the requirements of any fire restrictions or closures issued by the BLM Winnemucca District Office, as publicized in the local media or posted at various sites throughout the district.
- Personnel would be allowed to smoke only in designated areas and would be required to follow applicable BLM regulations regarding smoking.

Soils

The Project Area is relatively flat, with gentle slopes of less than 5 percent. Based on the low average annual precipitation of less than 9 inches per year (Western Regional Climate Center 2009) and relatively flat terrain within the Project Area, the potential for soil erosion should be minimal. Ormat would comply with the following lease stipulations and implement the following protection measures to minimize watershed and other resource damage:

Lease Stipulations

- All areas of exploration and or development disturbance will be reclaimed, including re-contouring disturbed areas to blend with the surrounding topography and using appropriate methods to seed with a diverse perennial seed mix. The seed mix used to reclaim disturbed areas would be "certified" weed free (applicable to entire Lease Area).

Applicant-Proposed Environmental Protection Measures

- Topsoil would be salvaged, stockpiled, and reused in a timely manner.
- All disturbed surfaces that are currently vegetated, including those that are disturbed temporarily during construction only, would be reseeded using the BLM-provided seed mix presented in Table 5.
- Erosion control measures, including but not limited to silt fencing, diversion ditches, water bars, temporary mulching and seeding, and application of gravel or riprap, would be installed, where necessary, immediately after completion of construction activities to avoid erosion and runoff.
- Access roads would follow existing contours to the maximum extent possible. In areas where new access roads must be constructed across slopes, erosion control measures such as silt fencing, surface roughening of slopes, and slope stabilization would be provided as necessary.
- An average of 6 inches of gravel would be used as road surface where appropriate because roads would be used during all seasons. Gravel applied to road surfaces and drill pads would be removed during reclamation as described in Section 2.1.8.2.
- Gravel would be laid down when ground conditions are wet enough to cause rutting or other noticeable surface deformation or severe compaction. As a general rule, if vehicles or other project equipment create ruts in excess of 4 inches deep when traveling cross-country over wet soils, a gravel surface would be added prior to additional vehicle use.
- In areas of very soft soils, up to 3 feet of aggregate would be used during construction.

Water Quality - Surface and Ground

Ormat would comply with the federal geothermal lease stipulations listed below. In order to further prevent and minimize potential impacts to water quality, Ormat would implement the environmental protection measures listed below.

Lease Stipulations

- Lease stipulations for all leased areas included in the Proposed Action prohibit surface occupancy, including well pad disturbance or construction, within 650 feet (horizontal measurement) of any surface water bodies, riparian areas, wetlands, playas, or 100-year floodplains unless specifically approved by the BLM (applicable to entire Lease Area).
- Lease stipulations for all leased areas included in the Proposed Action require development of a hydrologic monitoring program. This program would include documentation of subsurface information including the number of aquifers encountered, their properties, their quality, and their saturated thickness, for submittal to the BLM (applicable to entire Lease Area).
- The operator will monitor the quality, quantity, and temperature of any hot springs or other water resource within the Project Area whenever they are conducting activities which have the potential to impact those resources (applicable to entire Lease Area).

Applicant-Proposed Environmental Protection Measures

Surface Water

Several topographical drainages representing ephemeral, intermittent, or seasonal drainages exist in the proposed Project Area. No springs or wetlands are present within the Lease Area; however, Leach Hot Springs is located on private land immediately down-gradient and adjacent to the Lease Area. It is possible that impacts to surface drainages and Leach Hot Springs could occur during significant storm events. Potential releases of materials used during construction activities, primarily hydrocarbon releases from construction equipment, could potentially impact storm water. Prior to construction, Ormat would develop a spill and discharge contingency plan that details specific containment, cleanup and abatement, and notification procedures that would be implemented in the event of a spill or discharge. Ormat would implement BMPs during construction to prevent the contamination of storm water runoff.

The BMPs would include the following:

- When proposed new access roads must cross ephemeral washes, rolling dips would be installed. The rolling dips would be designed to accommodate flows from at least a 25-year storm event. Culverts could potentially be used wherever rolling dips are not feasible.
- Silt fences and/or straw bales would be used in areas requiring sediment control.
- Roads and well pads not required for further geothermal development purposes would be re-contoured to preconstruction conditions and seeded to prevent erosion.
- Access roads would follow existing contours to the maximum extent possible. In areas where new access roads must be constructed across slopes, erosion control measures such as silt fencing, surface roughening of slopes, and slope stabilization would be provided as necessary.
- Erosion control measures, including but not limited to silt fencing, diversion ditches, water bars, temporary mulching and seeding, and application of gravel or riprap, would be installed, where necessary, immediately after completion of construction activities to avoid erosion and runoff.

Groundwater

Ormat would implement various environmental protection measures to ensure that groundwater quality is not impacted from exploration drilling activities. The protection measures would include the following:

- Excavation into native soil during construction of well pad reserve pits would be minimized to the maximum extent possible.
- Drill pad reserve pits would be compacted during construction, and settled bentonite clay from drilling mud would accumulate on the bottom of the drill pad reserve pits to act as an unconsolidated clay liner, reducing the potential for drilling fluid to percolate to groundwater.

- A BLM-approved cementing and casing program for the drilling of exploration wells would be implemented to prevent water quality effects on groundwater during or after completion of the wells.
- Borehole geophysics analyses (cement bond logs) would be conducted to document that well casing cementing activities provide an effective seal isolating the geothermal aquifer from shallow alluvial aquifers, therefore minimizing potential impacts to the shallow aquifers potentially connected to surface springs, or streams.
- The project would use BMPs to ensure that any geothermal fluid encountered during the drilling does not flow uncontrolled to the surface. These include the use of "blow-out" prevention equipment during drilling and the installation of well casing cemented into the ground.
- Any well on the leased land that is not in use or demonstrated to be potentially useful would, upon approval by the BLM, be promptly plugged and abandoned in accordance with lease stipulations. No well would be abandoned until it has been demonstrated to the satisfaction of the BLM that it is no longer capable of producing in commercial quantities and would not serve any other useful purpose for this project such as for injection of geothermal fluids or monitoring of the geothermal reservoir or groundwater. All wells would be plugged on the completion of the project.

Biological Resources, Fish and Wildlife

The following lease stipulations and environmental protection measures would be implemented to minimize impacts to biological resources:

Lease Stipulations

- 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 modifications 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 of 1973 (ESA), 16 USC § 1531 *et seq.,* as amended, including completion of any required procedure for conference or consultation (applicable within entire Lease Area).
- Surface occupancy within 1 mile of occupied or identified potential Lahontan cutthroat trout (LCT) habitat is prohibited (applicable lease 76458).
- Controlled or limited surface use (avoidance and/or required mitigation measures to be developed) is applicable for all leases proposed in areas of crucial deer, antelope, and big horn sheep habitat during migration and critical fawning and kidding areas (applicable

leases N-74276 and N-76458).

- Prior to site development, a survey for invertebrates will be conducted on areas where geothermal surface expressions occur (applicable leases N-74276 and N-76458).

Lease stipulations pertaining specifically to sage-grouse

- Prior to entry on any lease areas which include known or potential habitat, the lessee (operator) shall contact the appropriate BLM Field Office to discuss any proposed activities (applicable leases N-74276 and N-76458).
- Sections 32 and 33 of T. 32 N., R. 39 E., lie within 0.6 mile of previously identified nesting and winter habitat. Section 5 and section 6, E1I2, E1I2NW1/4 of T. 31 N., R 39 E., also lie within 0.6 mile of previously identified nesting and winter habitat. Therefore, the sage-grouse stipulations apply to these sections. When an operations proposal is received by BLM, a site-specific EA will be prepared to evaluate impacts of the proposed operations.

  This document, prepared in consultation with the NDOW, will determine to what extent the stipulations below would be applied:

  The following stipulations apply to protect sage grouse and their habitat. Known habitat is defined as those areas where sage grouse have been observed. Potential habitat is an area where sage grouse may occur. **Known Breeding Habitat and Leks**: February through June, but may vary on site-specific basis. Avoid all activity within 3.3 km (2 miles) of known leks during the mating season - March through May, or as determined by Field Office and Wildlife personnel. Surface occupancy within 3.3 km (2 miles) of known leks is prohibited at all times. **Nesting Habitat and Brood-Rearing Habitats**: (April through August per Interim NV Guidelines) and Winter Habitats: (October through March). **Known Habitat**: Avoid all development or exploration activities within 3.3 km (2 miles)-- or other appropriate distance based on site-specific conditions--of leks, or within 1 km (0.6 mile) of known nesting, brood-rearing, and winter habitat. **Potential Habitat**: Avoid permanent occupancy of potential habitat. (Applicable lease N-76458.)

Lease stipulations pertaining specifically to migratory birds

Surface-disturbing activities during the migratory bird nesting season (March to July) may be restricted in order to avoid potential violation of the Migratory Bird Treaty Act (MBTA). Appropriate inventories of migratory birds shall be conducted during analysis of actual site development. If active nests are located, the proponent shall coordinate with BLM to establish appropriate protection measures for the nesting sites which may include avoidance or restricting or excluding development in certain areas to times when nests and nesting birds will not be disturbed. During development and production phases, if artificial ponds potentially detrimental to migratory birds are created, these shall be fitted with exclusion devices such as netting or floating balls (applicable within entire Lease Area).

Applicant-Proposed Environmental Protection Measures

- Trash and other waste products would be properly managed and Ormat would control garbage that could attract wildlife. All trash would be removed from the Project Area and disposed of at an authorized landfill.
- A speed limit of 25 miles per hour would be observed on roads within the Project Area, and if necessary, would be reduced when wildlife is active near access and service roads. The 25-mile speed limit would be posted at the project site.
- Employees and contractors would be strictly prohibited from carrying firearms (or similar hunting-type weapons) on the job site to discourage illegal hunting and harassment of wildlife.
- Reclamation of the disturbed areas, as described earlier in this document, would be completed in order to return these areas to the condition required in the drilling permit Conditions of Approval.
- The well pads would be constructed to avoid ephemeral washes to the extent practicable. The pads would be designed to divert sheet wash or water in drainages around and away from drill pads.
- Sagebrush seedlings would be planted during interim and final reclamation in topographic drainages and draws (typically areas of concentrated sagebrush) where project-related disturbance occured.
- Reserve pits would be constructed and fenced in accordance with the BMPs identified in the Gold Book (BLM 2007).

Vegetation

Lease Stipulations

- All areas of exploration and development disturbance will be reclaimed including re-contouring disturbed areas to blend with the surrounding topography and using appropriate methods to seed with a diverse perennial seed mix. The seed mix used to reclaim disturbed areas would be "certified" weed free (applicable to entire Lease Area).
- During all phases of exploration and development, Ormat shall maintain a noxious weed control program consisting of monitoring and eradication for species listed on the Nevada Designated Noxious Weeds List (NRS 555.010) (applicable to entire Lease Area).

Applicant-Proposed Environmental Protection Measures

- Impacts to vegetation would be minimized by reseeding all areas of access roads and well pads not required for subsequent energy production using weed free and BLM-approved seed mixtures (Table 5). Seeding would be conducted between October 1 and December 31. Disturbed areas would be re-contoured to blend with the surrounding topography. Topsoil would be salvaged whenever possible and reused in a timely manner.
- The well pads would be constructed to avoid ephemeral washes to the extent practicable. The pads would be designed to divert sheet wash or water in drainages around and away from drill pads.

- Sagebrush seedlings would be planted during interim and final reclamation in topographic drainages and draws (typically areas of concentrated sagebrush) where project-related disturbance occured.

Air Quality

In order to ensure impacts to air quality resulting from implementation of the Proposed Action are minimized, Ormat would put the following environmental protection measures into practice during construction and operation of the project:

- All applicable state and federal air quality standards would be met through the use of the best available technology to control emissions.
- Equipment and vehicle idling times would be minimized during construction and operation.
- A maximum speed limit of 25 miles per hour would be enforced on unpaved roads within the Project Area in order to reduce fugitive dust emissions.
- Access roads, Project Area roads, and other traffic areas would be maintained on a regular basis to minimize dust and provide for safe travel conditions.
- Proposed access roads would be surfaced with aggregate where appropriate.
- Dust abatement techniques, such as watering, would be used on unpaved roads and in areas where soils are exposed in order to reduce fugitive dust emissions.
- Dust abatement techniques, such as watering, requiring loader buckets to be emptied slowly, and minimizing drop heights, would be applied during earthmoving, excavating, trenching, grading, and aggregate crushing and processing activities.
- H_2S levels would be monitored during drilling of temperature gradient, observation, and production wells.

Noise

In order to protect the drilling crew and personnel from exposure to loud noise and reduce the total noise emissions of the project, Ormat would implement the following environmental protection measures:

- Noise suppression devices would be utilized on all compressors.
- Ear protection would be required for all personnel.

Land Use Authorizations

Ormat would comply with the lease stipulations provided below and implement the listed environmental protection measures to ensure that impacts to land use authorizations are avoided:

Lease Stipulations

- No drilling, including exploration or development activities within linear right-of-ways (ROWs), can be performed (applicable leases N-74276 and N-76458).

Applicant-Proposed Environmental Protection Measures

- Ormat would contact all parties that currently hold ROWs in the vicinity of the Project Area, including NV Energy, regarding overhead transmissions that cross the northern portion of the Project Area.
- Ormat would not perform any drilling activities within existing ROWs.
- Ormat would contact ROW holders for locations of underground utilities prior to commencement of project.

Visual Resources

To minimize temporary and permanent visual resource impacts resulting from construction of access roads and well pads and drilling of wells, Ormat would take the following actions:

- Standard dust control mitigation methods would be used during construction and grading.
- Cut and fill areas would be minimized by proper placement of roads and well pads.
- Features placed at the well pads would be removed after drilling and testing so that only the wellhead extends above the well pad. Wellheads would be painted a color that blends with the surrounding area, as approved by the BLM.
- Drill rig and well test facility lights would be limited to those required to safely conduct the operations.
- To avoid light pollution onto adjacent areas as viewed from a distance, Ormat would utilize directional lighting directed downward on to the pertinent site only and away from adjacent areas. Ormat would utilize lighting that is hooded and shielded for all lighting associated with the project so as not to allow the bulb to shine up or out with the exception of vehicle headlamps.

Paleontological Resources

Lease Stipulations

- Where significant paleontological resources are identified, mitigating measures such as data recovery, restrictions on development, and deletion of some areas from development may be required on a case by case basis (applicable leases N-74276 and N-76458).

Applicant-Proposed Environmental Protection Measures

- In the event that previously undiscovered paleontological resources are discovered in the performance of any surface-disturbing activities, the item(s) or condition(s) would be left intact and immediately brought to the attention of the authorized officer of the BLM.

Cultural, Archaeological, and Native American Resources

Lease Stipulations

The following lease stipulations have been attached to one or more of the federal geothermal leases that compose the Lease Area (Appendix A).

Ormat would comply with the following lease stipulations when performing any project activity resulting in new surface disturbance within the individual Lease Area or areas that each stipulation is applicable to.

- All surface-disturbing activities proposed after issuance of the lease are subject to compliance with Section 106 of the National Historic Preservation Act (NHPA) and its implementation through the protocol between the BLM Nevada State Director and the State Historic Preservation Officer (SHPO) (applicable to entire Lease Area).
- Surface occupancy within the setting of National Register–eligible sites where integrity of setting is critical to their eligibility is prohibited (applicable lease N-76458).
- Federal Geothermal Lease N-76458 and N-85717 may be found to contain historic properties and/or resources protected under the NHPA, American Indian Religious Freedom Act (AIRFA), Native American Graves Protection and Repatriation Act (NAGPRA), 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 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 (applicable leases N-76458 and N-85717).
- Surface occupancy within the setting of National Register–eligible TCPs where integrity of the setting is critical to their eligibility is prohibited. For development and production phases, surface occupancy may be limited to a specific distance or precluded at hot springs, pending conclusion of the Native American consultation process. All development activities proposed under the authority of this lease are subject to the requirement for Native American consultation prior to BLM authorizing the activity. Depending on the nature of the lease developments being proposed and the resources of concerns to tribes potentially affected, Native American consultation and resulting mitigation measures to avoid significant impacts may extend time frames for processing authorizations for development activities as well as change the ways in which developments are implemented (applicable to entire Lease Area).
- All development activities proposed under the authority of this lease are subject to the requirement for Native American consultation prior to BLM authorizing the activity. For development and production phases, surface occupancy may be limited to a specific distance or precluded at hot springs, pending conclusion of the Native American consultation process (applicable to entire Lease Area).

Applicant-Proposed Environmental Protection Measures

Ormat would implement the following environmental protection measures to minimize the potential impacts to cultural, archaeological, and Native American resources:

- Ormat would avoid known eligible and potentially eligible cultural resource sites through design, construction, and operation of the project.
- An approximately 100-foot buffer zone would be established around eligible and

potentially eligible cultural resource sites to help provide protection to the sites. Project facilities and disturbance would not encroach into the established 100-foot buffer zone.

- The project facilities would be operated in a manner consistent with the engineered design to prevent problems associated with the run-off that could affect adjacent cultural sites. This includes the use of BMPs to minimize off-site erosion and sedimentation.
- Ormat would limit vehicle and equipment travel to existing and proposed roads, well pad locations, and construction areas. Ormat would limit travel to existing roads in order to access the proposed mineral material site expansion area.
- Any unplanned discovery of cultural resources, items of cultural patrimony, sacred objects, human remains, or funerary items requires that all activity in the vicinity of the find ceases and the Field Manager, Humboldt River Field Office, 5100 East Winnemucca Boulevard, Winnemucca, Nevada 89445, be notified immediately by telephone (775.623.1500) with written confirmation to follow. The location of the find would not be publicly disclosed, and any human remains must be secured and preserved in place until a Notice to Proceed is issued by the authorized officer.

Noxious Weeds and Invasive, Non-native Species (Vegetation)

Lease Stipulations

Ormat would comply with the following lease stipulations which have been attached to each of the three individual federal geothermal leases that compose the Lease Area:

- All areas of exploration and development disturbance will be reclaimed including re-contouring disturbed areas to blend with the surrounding topography and using appropriate methods to seed with a diverse perennial seed mix. The seed mix used to reclaim disturbed areas would be "certified" weed free (applicable to entire Lease Area).
- During all phases of exploration and development, Ormat shall maintain a noxious weed control program (Appendix B) consisting of monitoring and eradication for species listed on the Nevada Designated Noxious Weeds List (NRS 555.010) (applicable to entire Lease Area).

Applicant-Proposed Environmental Protection Measures

Ormat would implement the following environmental protection measures to control spread or establishment of noxious weeds and invasive species within the Project Area:

- Ormat would map and treat areas that become infested with invasive species/noxious weeds during construction, and use certified weed-free seed and mulching materials in accordance with lease stipulations.
- Any new noxious weed infestations would be treated.
- Ormat would provide the BLM, Winnemucca District Weed Specialist with copies of pre-construction Geographic Information System (GIS) coverages and maps, along with related reports that depict, on all areas of exploration, the presence or absence and identity of any noxious weeds or invasive, non-native species.

- Ormat would also provide the BLM with copies of any similar information generated from the applicant's noxious weed control program over the term of the project.

Wetlands and Riparian Zones

Lease Stipulations:

- Surface occupancy is prohibited within 650 feet (horizontal measurement) of any surface water bodies, riparian areas, wetlands, playas, or 100-year floodplains to protect the integrity of these resources (as indicated by the presence of riparian vegetation and not actual water). Exceptions to this restriction may be considered on a case-by-case basis if the BLM determines at least one of the following conditions apply: (1) additional development is proposed in an area where current development has shown no adverse impacts, (2) suitable off-site mitigation will be provided if habitat loss is expected, or (3) BLM determines development proposed under any plan of operations ensures adequate protection of the resources (applicable to entire Lease Area).

Wastes, Hazardous and Solid

Ormat would comply with the lease stipulations provided below and implement the listed environmental protection measures to ensure that solid and hazardous wastes, if any, are managed in accordance with all applicable regulations.

Lease Stipulation

- Prior to exploration and development, an emergency response plan will be developed that includes contingencies for hazardous materials spills and disposal (applicable to entire Lease Area).

Applicant-Proposed Environmental Protection Measures

Ormat would implement the environmental protection measures listed below to ensure that solid and hazardous wastes, if any, are managed in accordance with all applicable regulations.

- A project hazardous material spill and disposal contingency plan would describe the methods for cleanup and abatement of any petroleum hydrocarbon or other hazardous material spill. The hazardous material spill and disposal contingency plan would be submitted to and approved by the BLM and made readily available on-site before operations begin in accordance with lease stipulations.
- Secondary containment structures would be provided for all chemical and petroleum/oil storage areas during drilling operations. Additionally, absorbent pads or sheets would be placed under likely spill sources and spill kits would be maintained on-site during construction and drilling activities to provide prompt response to accidental leaks or spills of chemicals and petroleum products.
- Handling, storage, and disposal of hazardous materials, hazardous wastes, and solid wastes would be conducted in conformance with federal and state regulations to prevent

soil, groundwater, or surface water contamination and associated adverse effects on the environment or worker health and safety.

- Portable chemical sanitary facilities would be available and used by all personnel during periods of well drilling and/or flow testing. These facilities would be maintained by a local contractor. All septic holding tanks would be located above ground.

2.3 ALTERNATIVES TO THE PROPOSED ACTION

During the EA process, the original Proposed Action was modified to address BLM and NDOW concerns regarding potential impacts to sage grouse and their habitat. The modified Proposed Action is presented and analyzed in this EA. Specifically, environmental protection measures have been incorporated into the Proposed Action to reduce environmental impacts to sage grouse and their habitat (e.g., planting seedlings for reclamation and reducing construction in concentrated sagebrush habitat) and alleviate the need to develop an action alternative to address the environmental conflict.

2.3.1 No Action Alternative

No exploration wells would be drilled and Ormat would be unable to evaluate the geothermal power development potential of the Lease Area. The No Action Alternative would preclude lease evaluation and the potential for energy production.

2.3.2 Alternatives Considered But Eliminated

Environmental protection measures have been incorporated into the Proposed Action to reduce the environmental impacts to sage grouse and their habitat (e.g., planting seedlings for reclamation and reducing construction in concentrated sagebrush habitat) and alleviate the need to develop an action alternative to address the environmental conflict.

Relocation of Access Roads

In order to access most of the well pad locations in T32N, R39E, section 31, Ormat originally proposed to construct a new road and utilize two existing roads on private land located east of Grass Valley Road and west of the Lease Area. The two existing roads are located near the Leach Hot Spring surface expression, particularly the southernmost road, which is located immediately adjacent to the spring. Typically, cultural resources and Native American artifacts are often concentrated near hot springs. The existing road conditions do not support travel and would require improvements before they could be utilized for Ormat's use. Due to their proximity to the hot spring, improvement activities could have impacted potential cultural and Native American resources. Additionally, the roads would be located on private land and it was undetermined whether permission to construct and utilize the access roads would be granted by the landowner. Upon further study, it was determined that the access roads proposed under the Proposed Action would provide a more direct route to the well pad locations and thus would result in less surface disturbance than this alternative. Additionally, surface disturbance would be moved farther from the hot spring and not occur on private land at all. Because this alternative

would require more surface disturbance than the Proposed Action and also result in impacts near the Leach Hot Springs, it has been eliminated from further analysis.

Relocation of Proposed Well Pads

Relocating 6 of the 12 proposed well pad locations was evaluated as an alternative to the Proposed Action. Under this alternative, the six eastern-most well pads in T32N, R39E, section 31 would be shifted approximately 1 mile west of the location where they are proposed under the Proposed Action. Directional drilling would be employed to explore the intended targets which are expected to occur beneath the well pad locations proposed under the Proposed Action. This alternative was evaluated with the intent to move project disturbances outside of the sage-grouse PMU and buffer and outside of the mule deer crucial winter range habitat.

The potential geothermal resources subject to exploration under the project are associated with narrow fault zones beneath the earth's surface. This type of association translates into a very limited drilling target zone for Ormat, and directional drilling would not be accurate enough to strike this target zone. Directional drilling can also add substantial economic strains to an exploration project, often increasing the cost of drilling a single well by several million dollars. Because of the inability to confidently strike drilling target zones, this alternative has been eliminated from further analysis.

CHAPTER 3
DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 SUPPLEMENTAL AUTHORITIES AND OTHER ELEMENTS OR RESOURCES

To comply with NEPA, the BLM must address specific elements of the environment according to procedural requirements defined by the Supplemental Authority associated with each element (BLM 2008a). The elements are essentially environmental resources, such as air quality and biological resources, which could be affected by Federal actions. The Supplemental Authorities are specified by the statutes, regulations, or executive orders additional to NEPA, such as the Clean Water Act and the ESA, which must be considered in all BLM environmental documents.

The following table outlines the Supplemental Authority elements that must be addressed in all environmental analyses, followed by other resources deemed appropriate for evaluation. Supplemental Authority elements determined to be Not Present or Present/Not Affected need not be carried forward for analysis or discussed further in the EA. Supplemental Authority elements determined to be Present/May Be Affected must be carried forward for analysis in the EA.

Table 6 Supplemental Authority Elements Considered for Analysis

Supplemental Authority Element	Not Present*	Present/Not Affected*	Present/May Be Affected**	Rationale
Air Quality			X	See Sections 3.2, 4.2, and 5.5.1.
Area of Critical Environmental Concern	X			Resource is not present.
Cultural Resources			X	See Sections 3.3, 4.3, and 5.5.2.
Environmental Justice	X			The Proposed Action would occur in an undeveloped, geographically remote area without an existing community or population. There are no environmental justice issues associated with the Proposed Action.
Farm Lands (Prime or Unique)	X			Resource is not present.
Invasive, Non-Native Species			X	See Sections 3.4, 4.4, and 5.5.4.
Native American Religious Concerns			X	See sections 3.6, 4.6, and 5.5.3.
Floodplains	X			Resource is not present.
Wetlands and Riparian Zones			X	Resource is not present within Project Area, but riparian areas associated with flow from Leach Hot Springs are located on adjacent private property. See Sections 3.19, 4.19, and 5.5.16.
Threatened, Endangered Species	X			Resource is not present.
Migratory Birds			X	See Sections 3.5, 4.5, and 5.5.5.

Supplemental Authority Element	Not Present*	Present/Not Affected*	Present/May Be Affected**	Rationale
Wastes, Hazardous and Solid			X	See Sections 3.7, 4.7, and 5.5.6.
Water Quality (Surface/Ground)			X	See Sections 3.8, 4.8, and 5.5.7.
Wild & Scenic Rivers	X			Resource is not present.
Wilderness	X			Resource is not present.

*A Supplemental Authority element determined to be Not Present or Present/Not Affected need not be carried forward or discussed further in the EA.

A Supplemental Authority element determined to be Present/May Be Affected **must be carried forward in the EA.

3.1.1 Additional Affected Resources

Other elements or resources of the human environment that have been considered for the EA are listed in Table 7. The rationale for each element that would not be affected by the Proposed Action or No Action Alternative is listed in the table.

Table 7 Other Elements or Resources Considered for Analysis

Other Resources	Not Present*	Present/Not Affected*	Present/May Be Affected**	Rationale
Rangeland Management			X	See Sections 3.14, 4.14, and 5.5.12.
Land Use Authorization			X	See Sections 3.17, 4.17, and 5.5.15.
Geology and Minerals			X	See Sections 3.10, 4.10, and 5.5.9.
Paleontological Resources			X	See Sections 3.9, 4.9, and 5.5.8.
Noise			X	See Sections 3.20, 4.20, and 5.5.17.
Recreation			X	See Sections 3.15, 4.15, and 5.5.13.
Soils			X	See Sections 3.11, 4.11, and 5.5.10.
Special Status Species			X	See Sections 3.18, 4.18, and 5.5.5.
Vegetation			X	See Sections 3.12, 4.12, and 5.5.11.
Visual Resources			X	See Sections 3.16, 4.16, and 5.5.14.
Wild Horses and Burros	X			There are no wild horses, wild burros, or Herd Management Areas for either animal within the Project Area. Resource is not present.
Wildlife			X	See Sections 3.13, 4.13, and 5.5.5.

*Resources or uses determined to be Not Present or Present/Not Affected need not be carried forward or discussed further in the document.

Resources or uses determined to be Present/May Be Affected **must be carried forward in the document.

The Proposed Action would be located entirely within Pershing County, Nevada, in a relatively undeveloped, geographically remote area with a sparse population. The closest city is Winnemucca, Nevada, which is about 25 miles north of the Project Area and located in Humboldt County. According to the U.S. Census Bureau, the total population of Winnemucca during the 2000 Census was estimated at 7,174 (U.S. Census Bureau 2000). The closest population center is an area known as Dutchman Acres, which is about 15 miles north of the Project Area. Since its formation in 1919, Pershing County has had an economy supported by mining, agriculture, tourism and services, and retail trade (Greater Pershing Partnership 2007). Lovelock, an unincorporated town located approximately 70 miles southwest of the Project Area, is the county seat for local government.

The following sections describe the affected environment for each resource that is present in Project Area and potentially affected by the Proposed Action. This information was derived from data gathered during a field investigation and from interviews and correspondence with the BLM and other federal, state, and local agency resource personnel.

3.2 AIR QUALITY

The Proposed Action would be located in a rural area with minimal industrial sources or potential contribution of emissions to the airshed from vehicle traffic. Activities associated with the Proposed Action would occur in Hydrographic Area 071, Grass Valley, within Pershing County, Nevada (Figure 9). In the state of Nevada, airsheds correspond to hydrographic areas, and therefore Hydrographic Area 071 is the analysis area for air quality. This basin is in attainment for all National Ambient Air Quality Standards (NAAQS) and Nevada air quality standards. In addition, the area is not a maintenance area for any criteria pollutants.

Regulatory Environment

The U.S. Environmental Protection Agency (EPA) Office of Air Quality Planning and Standards and the Nevada Division of Environmental Protection (NDEP) have set NAAQS and Nevada ambient air quality standards for the following criteria pollutants: nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter smaller than 10 microns in aerodynamic diameter (PM_{10}), particulate matter smaller than 2.5 microns in aerodynamic diameter ($PM_{2.5}$), ozone (O_3), and lead (Pb). In addition to the above-listed criteria pollutants, NDEP has established an ambient air quality standard of 0.08 parts per million (ppm) or 112 micrograms per cubic meter for H_2S. The minimum ambient air quality standards for Nevada are provided in NAC 445B.22097, as are the national standards. Attainment is achieved when the existing background concentrations for criteria air pollutants are less than the minimum allowable ambient concentrations defined in the NAAQS. The attainment status, with respect to the NAAQS, of the airshed in which the Proposed Action is located precludes the requirement for an air quality conformity analysis.

The Final Mandatory Reporting of Greenhouse Gases Rule issued by the EPA, as signed on September 22, 2009, requires suppliers of fossil fuels or industrial greenhouse gases (GHG),

manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions to submit annual reports to the EPA.

3.3 CULTURAL RESOURCES

Cultural resources include historic and prehistoric sites of interest and may include structures, archaeological sites, or religious sites of importance to Native American cultures. Section 106 of the NHPA as amended (16 USC 40 et seq.) requires federal agencies to take into account the effects of their actions on properties listed or eligible for listing on the National Register of Historic Places (NRHP). The National Park Service (NPS) defines archaeological and historic resources as "the physical evidences of past human activity, including evidence of the effects of that activity on the environment. What makes a cultural resource significant is its identity, age, location, and context in conjunction with its capacity to reveal information through the investigatory research designs, methods, and techniques used by archeologists" (NPS 1998). Ethnographic resources are defined as any "site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it" (NPS 1998).

The Project Area is in the traditional homeland of the Sawa'waktödö band ("Sage-brush Mountain dwellers") of Northern Paiutes. Only a few prehistoric sites have been found within a mile of the Project Area (Cannon et al. 2010:10). A Class III cultural resource inventory of the entire Project Area (excluding the proposed mineral material site expansion area) was conducted by Western Cultural Resource Management, Inc. (WCRM) during the spring of 2010, and the investigation results have been submitted separately to BLM (Canon et al. 2010). No prehistoric sites were found in the Class III survey of the Project Area. Three historic period sites were identified in the Project Area. The sites consist of historic period roads (CrNV-02-9578, CrNV-02-9579, CrNV-02-9596) and associated debris scatter. These roads appear to be feeder roads into a large network of roads. All three sites have been recommended *not eligible* for listing on the NRHP (Cannon et al. 2010).

WCRM performed a Class III cultural resource inventory of the area within the existing mineral material site boundary and the proposed mineral material site expansion area on January 15 and 16, 2011. One prehistoric site (CrNV-02-9995), one historic site (CrNV-02-9996), and one isolate find (I-1506) resulted from the survey. The prehistoric site consists of a lithic scatter that is recommended eligible for listing on the NRHP. This site was found within the boundaries of the existing mineral material site but outside of the boundaries of the proposed expansion area. The historic site and isolate find are recommended not eligible for listing on the NRHP. The January 15 and 16, 2011, survey also resulted in an update to a previously recorded site (CrNV-22-6658). This site is the old road to Austin, and it is recommended to remain not eligible for listing on the NRHP (Estes and Stoner 2011).

A cultural survey of the Hot Springs Ranch where Ormat may purchase and truck water from has not been performed. The ranch is on private land owned by A&B Paradise Enterprises, LLC, who has declined permission to permit a survey be performed on the property. However, in a letter to the

BLM, A&B Paradise Enterprises, LLC indicated that the well and surrounding area has been disturbed by past activities.

3.4 INVASIVE, NON-NATIVE SPECIES

Within Nevada, noxious weeds are defined in the Nevada Revised Statutes (NRS) 555.005 as "any species of plant which is, or is likely to be, detrimental or destructive and difficult to control or eradicate." The Nevada Department of Agriculture's Noxious Weed Web site (http://agri.state.nv.us/PLANT_NoxWeeds_index.htm) provides a list of all weeds listed as noxious for the state of Nevada as of 2008.

A noxious weed inventory was conducted at each of the 12 proposed well pad sites and on the alignments for the proposed new access roads by JBR Environmental Consultants, Inc. (JBR) on April 15, 2010. No noxious weeds were found during the inventory. Other invasive, non-native species were found, including cheatgrass (*Bromus tectorum*), Russian thistle (*Salsola kali*), and halogeton (*Halogeton glomeratus*). Tansymustard (*Descurainia pinnata*) was beginning to bloom near the northernmost proposed well pads.

Two state of Nevada noxious weeds, Russian knapweed (*Acroptilon repens*) and tall whitetop (*Lepidium latifolium*), are located along the side of Grass Valley Road. Russian knapweed is a Category B weed in Nevada, and tall whitetop is a Category C weed. Category B weeds are defined in NRS 555.010 as weeds established in scattered populations in some counties of the state. Control of Category B weeds is required by the state in areas where populations are not well established or previously unknown to occur. Category C weeds are defined in NRS 555.010 as weeds that are currently established and generally widespread in many counties of the state; abatement is at the discretion of the state quarantine officer.

3.5 MIGRATORY BIRDS

Migratory birds are protected and managed under the MBTA of 1918, as amended (16 USC 703 et. seq.), and Executive Order 13186. The MBTA prohibits the killing or taking of migratory birds and extends protection to nests of migratory birds if the nest contains nesting birds or their eggs. Executive Order 13186 directs federal agencies to promote the conservation of migratory bird populations. Additional direction comes from BLM Instruction Memorandum 2008-050 (Migratory Bird Treaty Act – Interim Management Guidance), dated December 18, 2007.

All birds in the Winnemucca District are considered neo-tropical migratory birds except for the gallinaceous (upland game) birds such as California quail (*Calipepla californica*), chukar (*Alectoris chukar*), and sage-grouse (*Centrocercus urophasianus*) and introduced species such as those in the starling (*Sturnidae*) family.

During a baseline survey on April 15, 2010, JBR observed the following migratory species at the Project Area: common ravens (*Corvus corax*), horned larks (*Eremophila alpestris*), sage

thrashers (*Oreoscoptes montanus*), western meadowlarks (*Sturnella neglecta*), white-crowned sparrows (*Zonotrichia leucophrys*), and a loggerhead shrike (*Lanius ludovicianus*). A golden eagle (*Aquila chrysaetos*) was observed flying north over the Project Area, and a ferruginous hawk (*Buteo regalis*), a BLM sensitive species, was found nesting in the Project Area.

Migratory species observed during the August 10 and 11, 2010, visit included a turkey vulture (*Cathartes aura*); mourning doves (*Zenaida macroura*); a single barn swallow (*Hirundo rustica*); horned larks; Brewer's, black-throated, and sage sparrows (*Spizella breweri*, *Amphispiza bilineata*, and *Amphispiza belli*, respectively); and western meadowlarks. A mourning dove nest with one egg and a newly hatched young was found in the eastern part of the Project Area. A loggerhead shrike was observed in the foothills approximately 1 mile east of the Project Area. Northern harriers (*Circus cyaneus*) were observed hunting in the Project Area on two occasions during the August visit.

Migratory birds observed during surveys conducted in the area on January 10 and 11, 2011, included a pair of golden eagles, common ravens, horned larks, and sage sparrows. Both horned larks and sage sparrows were noted in the area of the proposed mineral material site expansion. A song sparrow (*Melospiza melodia*) flushed from vegetation at Leach Hot Springs, outside of the Project Area. Approximately 30 chukar (an introduced gallinaceous species) were also observed in the mountains east and southeast of the Project Area. Also outside of the area, two male mallards (*Anas platyrhynchos*) flushed from a small pond at a mapped spring west of the Project Area and a female green-winged teal (*Anas crecca*) flushed from a pond at the Leach Hot Springs ranch.

Other migratory bird species not observed during the 2010-2011 surveys, but that may breed in or near the Project Area, include lark sparrows (*Chondestes grammacus*), house finches (*Carpodacus mexicanus*), Say's phoebes (*Sayornis saya*), and common poorwills (*Phalaenoptilus nuttallii*). The NDOW indicates the western part of the Project Area represents potential nesting habitat for the burrowing owl (*Athene cunicularia*). A variety of other species may pass through the area during migration. These include species that nest in other Great Basin habitats and species that breed outside the Great Basin but utilize the area during spring and fall migration.

The ferruginous hawk, golden eagle, loggerhead shrike, and burrowing owl are BLM sensitive species. Several other raptor species, some of which are BLM sensitive species, may also use the area to forage for food. See Section 3.18 for discussion on sensitive species and other special status species.

3.6 NATIVE AMERICAN RELIGIOUS CONCERNS

Numerous laws and regulations require consideration of Native American concerns. These include NHPA, AIRFA as amended, Executive Order 13007—Indian Sacred Sites, Executive Order 13175—Consultation and Coordination with Tribal Governments, NAGPRA, and the

Archaeological Resources Protection Act of 1979 (ARPA) as well as NEPA and Federal Land Policy and Management Act (FLPMA).

In general, water is considered to be sacred to the Paiute and Shoshone tribes. Hot springs are considered as sacred and often have medicinal properties associated with them. Ethnographic evidence suggests that springs in general were communally owned at the band level, and many times the use of springs required one to leave offerings at them (Stewart 1941:407, 440).

BLM HRFO initiated Native American consultation with the Lovelock Paiute Colony, the Fallon Paiute Shoshone Tribe, the Winnemucca Indian Colony, and the Battle Mountain Band Council with letters sent to the tribes on April 22, 2010. The letters provided a brief overview of the project and asked that the tribes initiate consultation or provide any comments or other expressions of interest in the project by May 28, 2010. Telephone messages from the BLM to the Winnemucca Colony were left on May 11, 18, and June 2, 2010. Telephone messages were left with the Battle Mountain Band on May 24, June 2, and June 8, 2010. The Fallon Paiute Shoshone tribe had no comment on the project in either the May or June, 2010 consultation meetings.

3.7 WASTES, HAZARDOUS AND SOLID

No hazardous wastes or hazardous materials are known to occur in the Lease Area. Numerous federal and state laws and regulations have been enacted and are enforced to ensure that hazardous materials, hazardous waste, and solid wastes are handled, stored, and disposed of properly.

3.8 WATER QUALITY (SURFACE/GROUND)

Surface Water

A number of topographical drainages representing ephemeral, intermittent, or seasonal streams exist in the Lease Area. Baseline surveys performed by JBR in April 2010 indicate that none of the drainages displayed an ordinary high water mark (OHWM) or other evidence of conveying surface flow on a regular basis. In general, these drainages direct surface flows westward across the Lease Area toward the center of Grass Valley. After reaching the center of the valley, surface water in Grass Valley generally flows northwest toward the Humboldt River.

U.S. Geological Survey (USGS) topographic maps indicate that flows from springs and drainages in Grass Valley terminate before reaching the Humboldt River or any tributary mapped as reaching the river. This indicates that none of the drainages appear to be jurisdictional Waters of the U.S. as defined by the U.S. Army Corps of Engineers. The Humboldt River is located about 25 miles northwest of the Project Area and flows westward.

The nearest springs are Leach Hot Springs, which are located on private land immediately adjacent to the Lease Area, and they may potentially be connected to the geothermal resource although they are more than 2,000 feet from the nearest proposed well pad location. Because of

their location and potential connection to the geothermal resource, Ormat obtained, upon BLM's request, current water quantity and quality information from these springs with the private land owner's permission.
JBR visited the Leach Hot Springs area on January 11, 2011, and measured the temperature at each individual spring source with a temperature probe. Flow measurements were recorded where practical below spring sources. Flows were measured with an electronic flow meter. Flow at several springs did not continue beyond the spring source.

Based on this one-time field survey, Leach Hot Springs consists of a hot spring complex with at least 15 separate orifices located in T32N, R38E, section 36 NENWSE with variable temperatures and flows. During this sampling event, flows varied from each orifice from dry to approximately 24.00 gallons per minute (gpm) with a total measured flow from all springs of 47.87 gpm. Flows and temperatures may change seasonally, as well as annually, based on other hot springs in the area. Temperatures range from 192 degrees Fahrenheit to 115 degrees Fahrenheit.

Another spring, located on private land, that may also be connected with the Leach Hot Springs complex is located in T32N, R38E, section 36 SWSWSE approximately 2,000 feet south-southwest of the main area. This secondary spring has been excavated and now consists of a pond with a temperature measured at 41 degrees Fahrenheit. The spring orifice could not be identified. The pond water level is reported (conversation with Bob Schweigert on Feb. 2, 2011) to be depressed by operation of an artesian well located approximately 700 feet to the southwest. This artesian well has a temperature of 118 degrees Fahrenheit.

Water samples for analysis of the State of Nevada Underground Injection Program suite (Sample List 2-Inorganic Extended) of constituents were collected at the hottest, coolest, and an intermediate-temperature surface expression site. The hottest and intermediate-temperature surface expressions are located in T32N, R38E, section 36 NENWSE. The coolest temperature surface expression is the spring located in T32N, R38E, section 36 SWSWSE, approximately 200 feet south-southwest of the main area. The temperatures and flows recorded at these sites are provided in Table 8 and shown on Figure 8. The water chemistry analysis results are also provided in Table 8.

Table 8 Geothermal Surface Expressions (Hot Springs) Water Quality Data

Parameter	Units	Drinking Water Standards*	Sample Location 1 (Warmest Spring)	Sample Location 2 (Intermediate Spring)	Sample Location 3 (Coolest Spring)
GPS coordinate	UTM NAD 83 Zone 11 North, Meters	N/A	Northing:4494951.8 Easting:445060.9	Northing:4494991.9 Easting:445031.6	Northing:4494320.4 Easting:444742.9
Flow	Gallons per Minute	N/A	Source lack flow	24.28	No flow data measureable
Temperature	Fahrenheit	N/A	192	147.5	41.3
pH	pH Units	6.5 – 8.5	7.52	7.95	7.77
Total Suspended Solids (TSS)	mg/L	N/A	23	1	12
Bicarbonate (HCO_3)	mg/L	N/A	96	350	390
Carbonate (CO_3)	mg/L	N/A	<1.0	<1.0	<1.0
Hydroxide (OH)	mg/L	N/A	<1.0	<1.0	<1.0
Total alkalinity	mg/L as $CaCO_3$	N/A	79	290	320
Total phosphorous as P	mg/L	N/A	0.062	<0.010	0.22
Chloride	mg/L	250	13	28	32
Fluoride	mg/L	2.0	3.5	6.8	6.6
Sulfate	mg/L	250	97	48	50
Nitrate nitrogen	mg/L	10	<0.010	<0.010	0.038
Nitrite nitrogen	mg/L	1	<0.010	<0.010	0.094
Total Dissolved Solids (TDS)	mg/L	500	430	570	580
Turbidity (nephelometric)	NTU	N/A	15	0.23	2.4
Electrical conductivity	µmhos/cm	N/A	480	800	870
Silica	mg/L	N/A	140	110	89
Aluminum	mg/L	0.05 – 0.2	1.4	<0.045	0.22
Antimony	mg/L	0.006	0.016	0.011	0.002
Arsenic	mg/L	0.010	0.004	0.003	<0.002
Barium	mg/L	2	0.062	0.18	0.21
Beryllium	mg/L	0.004	<0.0010	<0.0010	<0.0010
Boron	mg/L	N/A	0.56	1.2	1.2
Cadmium	mg/L	0.005	<0.0010	<0.0010	<0.0010
Calcium	mg/L	N/A	1.4	9.3	18
Chromium	mg/L	0.1	<0.0050	<0.0050	<0.0050
Copper	mg/L	1.0	<0.050	<0.050	<0.050
Iron	mg/L	0.3	0.57	<0.010	0.25
Lead	mg/L	0.015	<0.005	<0.005	<0.005

Parameter	Units	Drinking Water Standards*	Sample Location 1 (Warmest Spring)	Sample Location 2 (Intermediate Spring)	Sample Location 3 (Coolest Spring)
Lithium	mg/L	N/A	0.45	0.80	0.82
Magnesium	mg/L	N/A	<0.50	0.88	1.8
Manganese	mg/L	0.05	0.017	0.056	0.093
Molybdenum	mg/L	N/A	<0.010	<0.010	<0.010
Nickel	mg/L	N/A	<0.010	<0.010	<0.010
Potassium	mg/L	N/A	7.9	12	16
Selenium	mg/L	0.05	<0.002	<0.002	<0.002
Silver	mg/L	0.10	<0.0050	<0.0050	<0.0050
Sodium	mg/L	N/A	97	170	170
Thallium	mg/L	0.002	<0.001	<0.001	<0.001
Zinc	mg/L	5	<0.010	<0.010	<0.010
Mercury	mg/L	0.002	0.0040	0.00010	<0.00010
Gross Alpha	pCi/L	15 pico-curies/L	2.6±1.0	1.6±0.6	0.9±0.05
Gross Beta	pCi/L	4 millirems/year	<2.6	10.0±1.4	11.8±1.4
Free cyanide	mg/L	0.2	<0.010	<0.010	<0.010

*Drinking water standards are included in Table 8 as a reference to quantify the quality of the water only.

Groundwater

The Proposed Action would be located in Hydrographic Area 071, Grass Valley, in Hydrographic Region 04, Humboldt River Basin (Figure 9). The general direction of groundwater movement in the Grass Valley Hydrographic Area is northwest toward the Humboldt River (Cohen 1964). The Grass Valley Hydrographic Area has an area of 520 square miles and a perennial yield of 13,000 acre-feet per year (AFY). The basin has 42,098 AFY of committed underground water rights and no committed geothermal water rights (NDWR 2010a). The Grass Valley groundwater basin has been "designated" by the Nevada State Engineer. By Order 1171, dated August 7, 2003, the Nevada State Engineer declared that applications filed to appropriate groundwater pursuant to Nevada regulations within the Grass Valley basin would be denied unless exceptions are met. These exceptions include applications filed for commercial, industrial, stockwater, or wildlife purposes and only those applications that seek to appropriate 1,800 gallons per day or less on property zoned for such purposes. The Proposed Action would qualify for appropriation under the exception.

The general direction of groundwater movement in the Grass Valley Hydrographic Area is northwest toward the Humboldt River (Cohen 1964). This is the probable direction of flow for groundwater in the Lease Area, but data specific to flow within the Lease Area are not known to exist. The depth to groundwater in the Lease Area is also unknown, however, the NDWR Well Log Database (2011) was queried to determine the depth to static groundwater in wells drilled near the Lease Area. According to Well Log 110673, which corresponds to a stock well drilled in T31N, R39E, section 7, static groundwater was measured at approximately 160 feet below ground surface when the well was drilled in 2010 (NDWR 2010b). Well Log 28698 corresponds

to an artesian well on private land in T31N, R38E, NENW section 1, and indicates a static water level of approximately 2 feet above ground surface (NDWR 1987). A&B Paradise Enterprises, LLC. and JBR measured the depth to static groundwater at an existing well on private land in T32N, R38E, NWSW section 36, on February 2, 2011. The depth of groundwater in this well was measured at approximately 83.25 feet below ground surface. There are no known data that describe the quality of the groundwater in the Grass Valley Hydrographic Area near or on the Lease Area.

3.9 PALEONTOLOGICAL RESOURCES

Occurrences of paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them. The probability for finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. The Project Area is located on an alluvium-covered pediment above the floor of Grass Valley. The predominant geologic substrate has been mapped as Quaternary alluvium by the USGS (USGS 1969). Typically, coarse Quaternary alluvium contains no fossil remains because the environment of deposition is not conducive to fossil preservation. High-energy landslides and flood events that contribute to the build-up of alluvial fans and pediments are apt to mechanically degrade organic remains, and surviving material would be left on or near the surface in an oxidizing environment where it would soon decompose. As a consequence, fossils are generally not found in the proximal portions of the alluvial fans and pediments of mountains in the Great Basin.

Using the Potential Fossil Yield Classification (PFYC) system, the BLM is able to classify geologic units based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils, and their sensitivity to adverse impacts. Geologic units are assigned a class number ranging from one to five, with a higher class number indicating a higher potential of occurrence. The Project Area is classified as Class 3, Moderate Potential. Areas of Class 3 designation are known to contain vertebrate fossils or scientifically significant invertebrate fossils, but these occurrences are widely scattered. Common invertebrate or plant fossils may be found in the area. The potential for a project to be sited on or impact a significant fossil locality is low but is somewhat higher for common fossils.

3.10 GEOLOGY AND MINERALS

Grass Valley is a north-northwest/south-southeast-trending elongated valley in north-central Nevada, within the Great Basin Section of the Basin and Range physiographic province. The eastern edge of Grass Valley is defined by the Tobin and Sonoma Ranges, and the western edge is defined by the East Range. Alluvial fans and pediment surfaces flank the area between the mountains and the valley interior. The Proposed Action would be located on a gently sloped, alluvium-covered surface near the base of the southern tip of the Sonoma Range on the eastern edge of Grass Valley.

The Grass Valley basin is filled with a complex sequence of alluvial and lacustrine sediments ranging in grain size from clay to gravel. As is common in the Basin and Range Province, the depth to bedrock is likely greatest toward the center of the Grass Valley, located west of the Lease Area.

There are no active mining claims located in the vicinity of the Lease Area (BLM 2010a). There are additional geothermal leases in effect near the Project Area; however, they are not leased to Ormat. These leases are identified as N-85722 and N-85723 and are leased to Magma Energy (US) Corporation (BLM 2010a).

3.11 SOILS

Soils occurring within the Lease Area were mapped by the Soil Conservation Service (SCS) and are described in the *Soil Survey of Pershing County, Nevada, East Part* (SCS 1994). The SCS became the Natural Resources Conservation Service (NRCS) after publication of the Soil Survey.

Seven soil units are present in the Lease Area: 151, 233, 260, 591, 592, 905, and 1073 (Figure 10). The entire Project Area would be located within soil unit 151 (Blackhawk silt loam). This soil unit occurs on fan piedmont remnants between 4,000 and 4,500 feet. The Blackhawk soil generally occurs on 0 to 2 percent slopes, is well drained, flood hazard is none, and is moderately to strongly alkaline. The upper soils are generally composed of cobbled or gravelly silt loam. Salinity of the soil increases in lower soil layers. The soil is poorly suited for natural surface road construction because of low bearing strength and dust hazard. Blackhawk soil contains a cemented pan at a depth of less than 20 inches.

The other six soil units in the Lease Area are located outside of the Project Area. The soil units include 233 (Dunn Glen very fine sandy loam), 260 (Golconda silt loam), 591 (Trunk-Hoot association), 592 (Truck-Pocan association), 905 (Roca-Reluctan Variant association), and 1073 (Hoot, steep-Bojo-Hoot association) (SCS 1994).

3.12 VEGETATION

The vegetation species composition within the Lease Area is controlled primarily by elevation, available moisture, and soil substrate. GIS data from the Southwest Regional Gap Analysis Project (SWReGAP) indicate that two main land cover types are dominant in the Project Area: Inter-Mountain Basins Big Sagebrush Shrubland and Inter-Mountain Basins Mixed Salt Desert Scrub. The predominant species associated with the Inter-Mountain Basins Big Sagebrush Shrubland is big sagebrush (*Artemisia tridentata*). Scattered shrubs such as shadscale (*Atriplex confertifolia*) may be present in the cover type. The predominant species associated with the Inter-Mountain Basins Mixed Salt Desert Scrub are *Atriplex* spp., including shadscale and fourwing saltbush (*Atriplex canescens*) (SWReGAP 2004).

On April 15, 2010, JBR assessed the vegetation within the Project Area. Vegetation in the majority of the Project Area was dominated by shadscale, with smaller amounts of spiny hopsage

(*Grayia spinosa*), bud sagebrush (*Artemisia spinescens*), and bottlebrush squirreltail (*Elymus elymoides*) present. Big sagebrush (*Artemisia tridentata*) was present in several topographic drainages that cross the Project Area in an east to west direction. Smaller amounts of green (Douglas) rabbitbrush (*Chrysothamnus viscidiflorus*) and smooth horsebrush (*Tetradymia canescens*) were also observed. Understory vegetation was just beginning to emerge in mid-April, but globe mallow (*Sphaeralcea* sp.) was identifiable. The baseline findings are generally in concurrence with the SWReGAP Inter-Mountain Basins Mixed Salt Desert Scrub cover type.

On August 10 and 11, 2010, in response to BLM concerns over the extent of sagebrush in the Project Area, JBR delineated the occurrence of sagebrush within the footprint of potential disturbance in the Project Area. A 150-acre area, including a 10-acre block around each of the 12 proposed drill sites (each of which would include a maximum of 4.13 acres of disturbance) and the proposed access roads with a surrounding buffer, was surveyed. The buffers were included to allow flexibility in sitting drill sites and access roads. Within the 150-acre area, a total of 19.46 acres of sagebrush was identified.

On January 11, 2011, the proposed expansion area at the existing mineral material site located at the intersection of Grass Valley Road and the Goldbanks Hills Road (Figure 2) was surveyed for wildlife and vegetation present. Vegetation on undisturbed parts of this area is dominated by shadscale, tumble mustard (*Sisymbrium altissimum*), and cheatgrass.

3.13 WILDLIFE

The habitat in the Project Area is fairly uniform and is dominated by shadscale with small amounts of spiny hopsage, bud sagebrush, and bottlebrush squirreltail present. Big sagebrush is present in several topographic drainages that cross the Project Area in an east to west direction. Lesser amounts of green (Douglas) rabbitbrush and smooth horsebrush are also present.

According to a letter from Mr. Kenny Pirkle of NDOW dated April 20, 2010, the entire Lease Area is within pronghorn antelope (*Antilocapra americana*) habitat and distribution. The NDOW also noted that the higher elevation, eastern part of the Lease Area is identified as crucial mule deer (*Odocoileus hemionus*) winter range. Specifically, NDOW indicated that the portion of the Lease Area in T32N, R39E, sections 32 and 33, represents some of the best winter range in the area. Field observations indicated that the sagebrush habitats east of the Project Area are of particular importance because similar habitat to the north and south has been lost to wildland fires. The NDOW also noted that the Leach Hot Springs are an important water source for all wildlife in the area.

On April 15, 2010, and August 10-11, 2010, JBR surveyed the Project Area for wildlife species, including special status species. During both visits, black-tailed jackrabbits (*Lepus californicus*) and antelope ground squirrels (*Ammospermophilus leucurus*) were observed. One group of pronghorn antelope pellets was found in the area in April, and two antelope pellet groups were found in August. Rodent burrows and canid digging were common, particularly on areas of

mounded or dissected soil. During the August visit, kit fox (*Vulpes macrotis*) tracks were found on an existing two-track road that transits T32N, R39E, section 31, and a shed antler was found in the foothills approximately 1 mile east of the Project Area.

The area was again visited on January 10 and 11, 2011, to search for raptor nests within a 2-mile radius of the Project Area, assess areas east of the Project Area, including T32N, R39E, sections 32 and 33, for deer use, and survey the proposed mineral material site expansion area for vegetation and wildlife. One or two sets of older deer tracks were found in the snow in section 32, and one fresh set of tracks was found near the ridge east of the Project Area in T32N, R39E, section 34 approximately 2 miles east of the Project Area.

As described in section 3.18, two golden eagles were observed on transmission lines east of the northern part of the Project Area. A number of smaller stick nests were noted on transmission line structures, but most were small and appeared to be raven nests. A raven was present near one of these nests. A larger nest was found on a transmission line structure approximately 1.7 miles from the Project Area. No other raptor nests were found in the hills east of the Project Area or in trees at the Leach Hot Springs ranch, west of the Project Area. Chukar were flushed in the hills east of the Project Area, but no sage-grouse or sage-grouse sign were found. The tracks of coyotes, kit foxes, and mice were noted in the snow.

Several Great Basin whiptails (*Cnemidophorus tigris tigris*) were observed in the Project Area during the August visit. Other reptiles in the Project Area known or likely to occur include the northern sagebrush lizard (*Sceloporus graciosus graciosus*), desert horned lizard (*Phrynosoma platyrhinos platyrhinos*), common zebra-tailed lizard (*Callisaurus draconoides*), Great Basin gopher snake (*Pituophis melanoleucus deserticola*), and Great Basin rattlesnake (*Crotalus viridis lutosus*). The aquatic habitats present at Leach Hot Springs could support such species as the Great Basin spadefoot toad (*Scaphiopus intermontanus*) and potentially the BLM sensitive species northern leopard frog (*Rana pipiens*). The Leach Hot Springs sites were not surveyed during the April or August visits, as these sites are located on private land and permission to survey was not granted.

Migratory birds observed in the area included horned larks, common ravens, sage thrashers, several species of sparrow, and western meadowlarks. In April 2010, a golden eagle was observed flying north over the Project Area. BLM-designated sensitive bird species observed in the area included a nesting ferruginous hawk and a loggerhead shrike. No burrowing owls or potential burrowing owl burrows were found during the April survey, but the species may not have arrived in the area from wintering grounds to the south at the time of the April visit. Accordingly, the area was surveyed for burrowing owls on August 10 and 11, 2010. The entire Project Area and surrounding buffers, as described in Section 3.12 (except the proposed 10-acre area where the expansion of the existing mineral material site would be located), was searched for burrowing owls by pedestrian survey. No burrowing owls or evidence of burrowing owl presence was found. The location of the proposed mineral material pit expansion was finalized after the date of the August surveys. This area was surveyed in January 2011. Burrowing owls

would not be expected to occur in the area in January, but the area was searched for burrows that might represent burrowing owl nests. No larger burrows that might represent burrowing owl nests were found. Migratory birds are discussed in more detail in Section 3.5. Special status wildlife species are discussed further in Section 3.18.

3.14 RANGELAND MANAGEMENT

The BLM manages livestock grazing on over 9 million acres of public lands in the Winnemucca District. Laws that apply to the BLM's management of public lands grazing include the Taylor Grazing Act (TGA) of 1934, NEPA, the ESA, FLPMA, and the Public Rangelands Improvement Act (PRIA) of 1978. Today the BLM manages livestock grazing in a manner aimed at achieving and maintaining public land health. To achieve desired conditions, the agency uses rangeland health standards and guidelines that the BLM developed in the 1990s with input from citizen-based Resource Advisory Councils.

The BLM manages livestock grazing in over a hundred allotments throughout the District. An allotment generally consists of public lands, administered by BLM, but may also include parcels of private lands. These allotments consist of an area of land designated and managed by the Bureau where one or more livestock operators are authorized to graze their livestock. The BLM manages livestock grazing on public lands under 43 CFR 4100 and BLM Handbooks 4100 to 4180 (BLM 2009a and BLM 2001).

The Lease Area is within the Clear Creek and Dolly Hayden Allotments administered by the BLM HRFO. The Clear Creek and Dolly Hayden Allotments consist of approximately 48,370 acres and 53,154 of public lands and 12,359 acres and 54,203 acres of private lands, respectively. BLM authorizes cattle grazing annually in both of the allotments consistent with the livestock operators permits identified in Table 9 below.

Table 9 Livestock Grazing Information

Allotment	Authorization No.	Cattle No.	On Date	Off Date	Animal Unit Months*
Clear Creek	2702029	267	January 1	June 30	1589
		160	July 1	September 15	405
		267	September 16	December 31	939
Dolly Hayden	2702061	523	December 1	January 31	1067

Source: BLM 2009b

*Animal Unit Month (AUM): The amount of forage needed to sustain one cow, five sheep, or five goats for a month

Specific to the Project Area, there are no livestock water developments; however, there is a range improvement project (Grass Valley Road Fence) that traverses the western portion of the Lease Area, along Grass Valley Road, and separates the Clear Creek and Dolly Hayden Allotments. The Grass Valley Road Fence is constructed along the county road ROW, with one area of exception. That area of exception is where the fence, on both sides of Grass Valley Road, diverts around the private lands in T32N, R38E, section 35 and section 36, as well as portions of T31N, R38E, section 1.

3.15 RECREATION

Recreational use in the Project Area is relatively low compared with other areas in the Winnemucca District, with the majority of visitors likely being residents of Humboldt and Pershing counties. While off-highway vehicle (OHV) use is permissible within the Leach Hot Springs area, recreation is generally limited to seasonal hunting. The recreational use can be described as "Dispersed Recreation," indicating that at the present time there are no established recreation trails, campgrounds, parks, or permitted recreational activities that take place in the Project Area. Hunting and occasional OHV travel comprise the predominant recreational activities in the Project Area.

3.16 VISUAL RESOURCES

The BLM's Visual Resource Management (VRM) process manages the quality of landscapes on public land and evaluates the potential impacts to visual resources resulting from development and land utilization activities. VRM class designations are determined by assessing the scenic value of the landscape, viewer sensitivity to the scenery, and the distance between the viewer and the subject landscape. These management classes identify various permissible levels of landscape alteration while protecting the overall visual quality of the region. They are divided into four levels (Classes I, II, III, and IV). Class I is the most restrictive, and Class IV is the least restrictive (BLM 1986).

The proposed Project Area is located within a Class IV visual resource management category. The objective for this class is to provide for management activities that allow major modifications to the existing character of the landscape. The level of change to the landscape characteristics can be high. Activities in a Class IV category may dominate the view and be the major focus of viewer attention. Every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic landscape elements.

In general, the aesthetics of the area surrounding the Project Area can be described as an altered landscape typical of central Nevada. The landscape consists of large, open spaces with a backdrop of tall mountains in the distant horizon. Predominant vegetation in this area consists of scattered low shrubs with areas of exposed soil. Dominant natural features in both the fore- and middle-ground of the Project Area consist of low rolling hills. The natural landscape has been altered by manmade structures and construction, largely associated with ranching and grazing activity. Numerous fences, unpaved roads, and overhead power transmission lines intersect the general area. Grass Valley Road is a maintained unpaved public road that runs north-south through the western portion of the Lease Area. The closest sensitive receptor (park, church, residence, school, hospital, etc.) is a single residence located west of Grass Valley Road and approximately 3,500 feet west of the proposed Project Area. The next nearest fixed or stationary receptor is another residence located more than 5 miles away.

There are no light pollution emission sources within the proposed Project Area. The single residence located approximately 3,500 feet west of the Project Area represents the only source visible from the Project Area. The absence of other light sources in the area results in a relatively dark landscape. A single light source in a relatively dark landscape may be more conspicuous to a receptor than that same light source in a well-lit landscape. Therefore, as a single light source, the residence represents a source of light into the otherwise dark landscape.

Although the single residence represents an intrusion into the dark landscape, it does not affect dark sky resources in the area. According to the International Dark-Sky Association (IDA), four components of light pollution contribute to degradation of dark sky resources (IDA 2009). These components include:

- **Urban Sky Glow**—the brightening of the night sky over inhabited areas.
- **Light Trespass**—light falling where it is not intended, wanted, or needed.
- **Glare**—excessive brightness which causes visual discomfort. High levels of glare can decrease visibility.
- **Clutter**—bright, confusing, and excessive groupings of light sources, commonly found in over-lit urban areas. The proliferation of clutter contributes to urban sky glow, trespass, and glare.

None of these four components are present at the residence or elsewhere in the vicinity of the proposed Project Area. Consequently, dark sky resources in the area are relatively well-preserved.

3.17 LAND USE AUTHORIZATION

In addition to Ormat's federal geothermal leases, several ROWs or other authorizations have been granted on public lands that are adjacent to, or cross, the Project Area. These include ROWs for linear projects such as overhead transmission lines and roads, as well as ROWs for a mineral material (sand and gravel) site.

Two ROWs for overhead transmission lines (N-24394 and N-7639A) have been granted to NV Energy (formerly Sierra Pacific Power) in T32N, R38E, sections 25 and 36, and T32N, R39E, section 30. A free use permit has been granted to Pershing County, Nevada (N-79708) and the BLM (N-81087) for a mineral material site within the Lease Area, just west of Grass Valley Road in T31N, R38E, section 1. Pershing County also holds a ROW (N-53032) granted under Revised Statute 2477 (RS-2477) for a road in T31N, R38E, section 1, and T32N, R38E, sections 25 and 36. Prior to its repeal in 1976, the statute granted counties and states a ROW across federal land when a highway was built. Another road ROW (N-57131) is located in T31N, R38E, section 1, and is held by Kinross Gold USA. Table 10 provides a summary of the ROWs adjacent to, or crossing, the Project Area, and Figure 3 shows the ROWs.

Table 10 ROW Authorizations Adjacent to or Crossing the Project Area

BLM Serial Number	Section, Township, Range	ROW Use/ Authorized Activity	ROW Holder(s)
N-24394	T32N, R38E, sections 25 and 36, and T32N, R39E, section 30	Overhead transmission line	NV Energy (formerly Sierra Pacific Power)
N-7639A	T32N, R38E, sections 25 and 36, and T32N, R39E, section 30	Overhead transmission line	NV Energy (formerly Sierra Pacific Power)
N-57131	T31N, R38E, section 1	Access road	Kinross Gold USA
N-53032	T31N, R38E, section 1, and T32N, R38E, sections 25 and 36	RS 2477 road	Pershing County, NV
N-79708 (expired)	T31N, R38E, section 1	Mineral material free use permit	Pershing County, NV
N-81087	T31N, R38E, section 1	Mineral material free use permit	BLM

3.18 SPECIAL STATUS SPECIES

Special status species include species listed or proposed for listing under the ESA as threatened or endangered, proposed species, candidate species, and species included on the BLM's sensitive species list for Nevada (NV-2003-097). Candidate species are those species or subspecies (i.e., taxa) that may warrant listing as threatened or endangered; there is sufficient information on biological vulnerability and threat(s) to support a rule to list these species as threatened or endangered, but the issuance of a proposed rule to list is precluded by higher listing priorities. Proposed species are taxa for which a proposal to list the species as threatened or endangered has been published in the Federal Register.

According to a letter from the U.S. Fish and Wildlife Service (USFWS) dated April 16, 2010, federally listed or proposed plant or animal species are not known to occur in the Project Area (Appendix C). However, the USFWS letter does indicate that the candidate wildlife species greater sage-grouse (*Centrocercus urophasianus*) may occur within the Lease Area. In a letter dated April 20, 2010, NDOW indicated that the eastern half of the Lease Area is within greater sage-grouse winter, nesting, and early brood habitat. The eastern extent of the Project Area is within the limits of the Sonoma PMU for sage-grouse and includes NDOW-identified sage-grouse winter, nesting, and early brood-rearing habitat. Sagebrush was found in drainages in this area, but no evidence of sage-grouse, including sage-grouse pellets or tar, was found in this area. Sagebrush habitat is limited and consists of approximately 12 percent of the entire 160-acre Project Area. Therefore, as a result of the limited quantity of sagebrush habitat in the Project Area, the discontinuity of sagebrush habitat throughout the Project Area, and the lack of evidence of the species' presence during surveys conducted in the Project Area, sage-grouse use of the area appears low to none.

Sensitive Species

Sensitive species are taxa that are not already included as BLM special status species under (1) federally listed, proposed, or candidate species or (2) State of Nevada listed species. BLM policy in BLM manual 6840.06 states, "Actions authorized by the BLM shall further the conservation and/or recovery of federally listed species and conservation of Bureau sensitive species. Bureau sensitive species will be managed consistent with species and habitat management objective in land use and implementation plans to promote their conservation and to minimize the likelihood and need for listing under the Endangered Species Act of 1971, as amended under the ESA" (BLM 2008c).

The BLM affords these species the same level of protection as federal candidate species. The BLM's policy for sensitive species is to avoid authorizing actions that would contribute to listing a species as threatened or endangered.

In a letter dated April 12, 2010, the Nevada Natural Heritage Program (NNHP) indicated that it does not have any records of special status species within the Lease Area (Appendix C). In a subsequent letter, dated December 2, 2010, NNHP indicated habitat for the Pleasant Valley springsnail (*Pyrgulopsis aurata*) may occur at Leach Hot Springs (Appendix C). Personal communication with Dr. Robert Hershler, aquatic biologist at the University of Nevada, Las Vegas, indicated that Dr. Gary Vinyard, aquatic biologist at the University of Nevada, Reno, had searched the hot springs for springsnails in 1993 but had found no springsnails present. The current owner of the hot springs did not permit further surveys of the springs for springsnails.

In its April 20, 2010, letter, the NDOW indicated that most sensitive species and habitat occurs in the eastern half of the Lease Area (Appendix C). The six drill sites located in T32N, R39E, section 31 are located within the western edge of NDOW-identified sage-grouse nesting, brood-rearing, and wintering habitat. BLM Lease NVN-76458 states: "Avoid all activity within 2 miles or other appropriate distance based on site specific conditions, or leks, or within 0.6 miles of known nesting, brood rearing and winter habitat." This language is not attached to the lease stipulations in the leases where Ormat is proposing to drill (NVN-74276 and NVN-85717), but language in the stipulations for these leases does state that the "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." During surveys in April and August 2010 and January 2011, JBR found no evidence of sage-grouse use of habitats in the Project Area.

In addition to identifying the eastern half of the Lease Area as sage-grouse winter, nesting, and early brood-rearing habitat, NDOW indicated the eastern half of the Lease Area is within desert bighorn sheep (*Ovis canadensis*) habitat and distribution. Desert bighorn sheep are considered BLM sensitive species in the state of Nevada. The NDOW noted that although there is no resident bighorn sheep population in this area, bighorn sheep do move through the area. The NDOW has subsequently indicated bighorn sheep use of this area is transitory. No evidence of bighorn sheep was noted in the Project Area during field surveys.

The NDOW indicated the western half of the Lease Area, which includes the Project Area, is within burrowing owl (*Athene cunicularia*) habitat and distribution. Open habitats in the Project Area represent potential burrowing owl nesting habitat. No burrowing owls or potential burrowing owl burrows were found during the April 2010 survey, but the species may not yet have arrived in the area from wintering grounds further south at the time of the April surveys. Accordingly, the area was revisited on August 10 and 11, 2010, and surveyed for burrowing owls. The Project Area, including proposed drill pad footprints and access roads, was searched via thorough pedestrian survey. The Project Area was traversed by multiple transects spaced approximately 100 to 300 feet apart and searched for owls, burrows, and/or owl pellets. No burrowing owls or potential owl burrows were found. The site of the proposed gravel pit was searched for potential burrowing owl burrows in January 2011. No large burrows that could represent burrowing owl nests were found.

The NDOW also identified a raptor nest as existing in the Project Area. JBR located the nest during the April 2010 survey. The nest was active and occupied by a ferruginous hawk (*Buteo regalis*), a BLM sensitive species.

A loggerhead shrike was also observed during the April 2010 survey. Loggerhead shrikes prefer shrubs, such as sagebrush, for nesting. Although limited, nesting habitat for the loggerhead shrike may be present in sagebrush habitats that occupy the topographic drainages that cross the Project Area. The area also represents potential foraging habitat for prairie falcons (*Falco mexicanus*) and Swainson's hawks (*Buteo swainsoni*), both BLM sensitive species.

A golden eagle was observed in the Project Area in April 2010. Two golden eagles were observed on transmission lines east of the northern end of the Project Area in January 2011. Potential nesting habitat within a two-mile radius of the Project Area was searched for other potential raptor nests. In addition, two parallel electrical transmission lines that traverse the Project Area were searched for raptor nests. A number of smaller nests, most apparently being common raven nests, were found on the transmission lines. No nests were found in trees on the Leach Hot Springs ranch, west of the Project Area. One larger nest was observed approximately 1.7 miles west of the Project Area. No birds were observed near this nest. Due to the lack of cliffs, rock outcrops, and tall trees, it is likely the area serves only as foraging habitat for the golden eagle. In a letter dated September 14, 2010, Mr. Timothy Herrick of the NDOW provided data indicating that the nearest known golden eagle nest is located over 4 miles from the Project Area. Conversation with the USFWS determined that the proposed exploration activities, which would result in a maximum of 69.79 acres of disturbance, are unlikely to result in any more than minor impacts to potential golden eagle foraging habitat in the area.

Areas of sagebrush vegetation present in the Project Area represent potential habitat for pygmy rabbits (*Brachylagus idahoensis*), another BLM sensitive species. Areas of sagebrush within the Project Area, including drainages supporting sagebrush that would be crossed by access roads, were searched for pygmy rabbits or evidence of this species, including burrows and small pellets. These habitats were surveyed in April 2010 and again in August 2010, when sagebrush habitats

in the area were delineated. During the April surveys, sagebrush habitats were traversed by one or more transects spaced approximately 25 to 30 feet apart, and the areas were searched for any evidence of pygmy rabbits. During the August surveys, in addition to traversing the interiors of sagebrush habitat, the edges of sagebrush habitat were walked and a series of GPS points were recorded to delineate the extent of sagebrush habitat in the Project Area. Wider occurrences of sagebrush (primarily in the drainage south of the existing east-west road in the area) were again traversed by walking multiple transects parallel to the sagebrush habitat to ensure complete coverage of potential pygmy rabbit habitat in the Project Area. No pygmy rabbits, pygmy rabbit burrows, or pygmy rabbit pellets were found in the Project Area. No evidence of pygmy rabbits was found in the area during either the April 2010 or the August 2010 surveys.

A number of bat species identified as sensitive by the BLM (pallid bat, *Antrozous pallidus*; Townsend's big-eared bat, *Corynorhinus townsendii*; big brown bat, *Eptesicus fuscus*; several species of *Myotis*) may forage in the area. Most foraging would be expected to occur in the Leach Hot Springs area, where flying insects would be most common, but foraging may occur throughout the area. No mine workings, outcrops, or other potential bat roosting sites are present in the Project Area.

Appendix D includes a table listing BLM sensitive species and their potential to occur within the Project Area. Note that Mojave Desert species found in southern Nevada have been eliminated from further discussion in the table because the Project Area is situated well outside of the range of these species.

3.19 WETLANDS AND RIPARIAN ZONES

The Leach Hot Springs are located immediately adjacent to and down-gradient of the Lease Area on private land, approximately 2,000 feet from the nearest proposed well pad. The springs include associated riparian zones and probable wetland areas. Based on aerial photography, the riparian zone surrounding the Leach Hot Springs is approximately 8.9 acres in size.

3.20 NOISE

The rate at which noise attenuates, or decreases, in outdoor settings is dependent on several factors, including atmospheric conditions, terrain, and the physical distance separating the noise source from the noise receptor. The distance separating a noise source and noise receptor alone will result in some degree of noise attenuation. Generally when noise is emitted from a point source, the noise is attenuated an average of 6 decibels each time the separating distance is doubled.

Existing noise emissions in the general vicinity of the Project Area include general environmental noises resulting from wildlife and weather. Existing noise emissions also include vehicular traffic in the vicinity of the Project Area.

CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

4.1 ANALYSIS OF ENVIRONMENTAL CONSEQUENCES

The following sections describe the direct and indirect environmental consequences which would result from authorization of the Proposed Action and the No Action Alternative. Cumulative impacts are analyzed in Chapter 5. Review of the environmental consequences identifies both direct and indirect, temporary and permanent impacts resulting from both the Proposed Action and the alternative. Impacts to resources resulting from surface disturbance were analyzed under the assumption that all 12 proposed well pads would be constructed to their maximum size, which would represent the allowable extent of surface disturbance. This also assumes that Ormat would drill all three types of exploratory wells at each pad site, drill the two proposed groundwater wells, expand the existing mineral material site by 10 acres, and improve or construct all access roads. Actual disturbance would likely be less, as most well pads would not contain all three types of wells, and some may not be constructed at all.

The existing conditions for each resource below can be found in Chapter 3.

4.2 AIR QUALITY

4.2.1 Proposed Action

Fugitive Dust

The Proposed Action has the potential to disturb approximately 69.79 acres. Surface disturbances would increase fugitive particulate dust entrainment in the vicinity of the project for the duration of the project. The construction of the proposed access roads and well pads, as well as travel on access roads and drilling on well pads, would create fugitive dust emissions in the form of PM_{10} and $PM_{2.5}$ that would have a potential impact on air quality. Fugitive dust, in the form of PM_{10} and $PM_{2.5}$, would be caused by the operation of the following equipment: up to eight ¾- to 1-ton pick-up trucks, one water truck, two dump trucks, one bulldozer, one road grader, and two drilling rigs. Table 11 summarizes the fugitive dust emissions that would result from the Proposed Action.

In order to minimize the potential air quality impacts resulting from fugitive dust emissions, Ormat would implement the environmental protection measures described in Section 2.2. These protection measures include dust abatement initiatives such as watering access roads and well pads to minimize localized increases in particulate matter concentrations and limiting vehicle and equipment speeds to 25 miles per hour on project roads. Aggregate (gravel) would be applied to proposed access roads as needed and would further reduce fugitive dust emissions caused by travel on unpaved roads. Additionally, because the total disturbance area would exceed 5 acres, Ormat would be required to obtain a Surface Area Disturbance Permit from the NDEP Bureau of Air Pollution Control (BAPC).

The permit would require Ormat to prepare a corresponding Dust Control Plan that lists best practical methods for control of fugitive emissions. The environmental protection measures combined with the Dust Control Plan would result in minimal to negligible fugitive dust emissions. It is anticipated the Dust Control Plan in combination with environmental protection measures would limit air quality impacts resulting from fugitive dust emissions to minimal. Reclamation of proposed surface disturbance would gradually eliminate fugitive dust from wind erosion.

Combustion Emissions

Combustion emissions would result from operation of internal combustion engines that power the equipment and vehicles that would be used to construct and operate the Proposed Action. Vehicle emissions in the form of NO_x, SO_2, and CO would occur any time the internal combustion engines are operating. However, vehicle emissions are regulated by the EPA and are controlled by specific design requirements when the vehicle is manufactured. The primary emission sources during construction of the project would be from operation of pick-up trucks, a water truck, dump truck, bulldozer, and a road grader. Several pieces of equipment and vehicles equipped with internal combustion engines would be used during drilling as well, but the principal emission source during this period would be associated with the large diesel-powered engine(s) on the drill rig. Diesel generators would be used through construction and operation of the Proposed Action, and pumps would be used during drilling and well testing. These pieces of equipment would also generate combustion emissions that would have a potential impact on air quality. The Proposed Action would be implemented over the next one to five years, and therefore emissions would be temporary for the duration of this period. Table 11 summarizes the NO_x, SO_2, and CO emissions that would result from operation of project-related equipment powered by internal combustion engines.

Combustion emissions would be anticipated to become dispersed within close proximity to the Project Area due to wind and relatively minimal concentrations of pollutants as demonstrated in Table 11. Additionally, vehicles would be operated along various roadways within the Project Area and varying operational times through any period; thus concentrated emissions would be less likely. Along with natural wind dispersion, the environmental protection measures described in Section 2.2 would be implemented to minimize the effects of combustion emissions on existing air quality. These measures would require idling of engines be limited to 15 minutes; equipment idling for periods longer than 15 minutes would be turned off. This would reduce the overall time that NO_x, SO_2, and CO are produced by combustive processes. Given the low background concentrations of criteria pollutants in the Project Area and the limited emissions from combustion associated with the proposed project equipment and vehicles, implementation of the Proposed Action would not be anticipated to result in emissions excessive of any of the federal or state air quality standards. Combustion emissions resulting from implementation of the Proposed Action would be anticipated to be minimal over the life of the project as demonstrated in Table 11.

Table 11 Summary of Total Estimated Fugitive and Combustion Emissions

Equipment	Quantity	Total Tons of Pollutant				
		PM_{10}	$PM_{2.5}$	SO_2	NO_x	CO
Diesel generators	2	2.23	2.23	2.08	31.39	6.76
Air compressor	2	0.74	0.74	0.69	10.46	2.25
Production drill rig generator	2	4.46	4.46	4.15	62.78	13.53
3/4- to 1-ton pick-up trucks	8	219.74	21.98	0.005	0.42	6.96
Flatbed truck	2	0.0002	0.00005	0.00004	0.004	0.06
Water truck	1	58.48	5.85	0.0045	0.42	6.96
Dump truck	2	108.31	10.83	0.0026	0.24	3.96
Truck-mounted drill rig	2	0.02	0.005	0.0039	0.35	5.94
Semi trucks	40	0.001	0.0003	0.0003	0.02	0.41
Backhoe	2	0.06	0.01	0.07	0.35	1.03
D8 bulldozer	1	0.28	0.08	0.10	0.47	1.38
Compactor	1	0.03	0.00	0.04	0.18	0.52
Front end loader		0.25	0.02	0.30	1.47	4.30
Crane		0.02	0.002	0.02	0.12	0.34
Drilling - fugitive	N/A	0.44	0.03			
TOTAL		**395.04**	**46.23**	**7.47**	**108.66**	**54.42**

Note: Fugitive dust emissions as a result of travel along the roadways and surface area disturbance by equipment were derived using United States Environmental Protection Agency (USEPA) emission factors from AP-42 Sections 13.2 and 11.9. The combustive emissions for non-road equipment were derived using USEPA AP-42 Tier II non-road engine emission limits. Combustion emissions for all on-road equipment were derived using USEPA's MOBILE6 model. All emissions were estimated at maximum operation over the lifetime of the project.

Hydrogen Sulfide and Other Emissions

Non-condensable gases would be released to the atmosphere during the drilling and testing of observation wells and production wells. These gases would be released when geothermal fluids are exposed to the atmosphere; consequently, drilling a temperature gradient well would not be anticipated to result in an emission since geothermal fluids are not encountered. The amount and ratio of the non-condensable gas constituents within the geothermal fluid are variable among geothermal resource areas and can be substantially different among individual wells within the same geothermal Project Area. The non-condensable gas content typically comprises carbon dioxide (CO_2) (usually accounting for about 95 to 98 percent of the total non-condensable gas content) with smaller amounts of methane (CH_4), H_2S, and trace amounts of ammonia (NH_3). Trace amounts of elements such as mercury and arsenic may be present. Emissions from the wells and test facilities would be transported and dispersed by wind away from the well pads. The Western Regional Climate Center (WRCC) has compiled the prevailing wind direction during each calendar month at the Winnemucca Municipal Airport using hourly data collected from the years 1992 to 2002. The prevailing wind direction is defined as the direction with highest percent of frequency during each month. According to the WRCC the prevailing direction of wind is north during the months of October through March and east during the

months of April through September (WRCC 2010). Based on these data, wind would generally be anticipated to carry gas emissions away from Grass Valley Road.

Small amounts of methane, ammonia, and heavy metals would disperse from the Project Area. Emission of these constituents would occur only during flow testing, which would typically last five days per tested production well and three days per tested observation well. No acute or long-term impacts would be expected from emissions due to the short duration of testing and the small amounts of these constituents being released. As described above, prevailing wind directions would generally disperse emissions away from Grass Valley Road. Carbon dioxide is a greenhouse gas. Most of the non-condensable emissions from flow testing would be carbon dioxide. The state and federal government do not have standards for CO_2 emissions at this time.

The non-condensable gas of primary concern that would have potential for emissions when geothermal fluids are exposed to the atmosphere is H_2S. The amount and ratio of H_2S within geothermal fluid is variable and can have substantial variation among wells within the same geothermal Project Area. Although there is no federal air quality standard for H_2S, Nevada has adopted an hourly ambient air quality standard of 112 µg/m3 for H_2S (0.08 ppm) (NAC 445B.22097). The amount and ratio of H_2S potentially present in subsurface geothermal fluids cannot be determined until more data are obtained from drilling and the fluids are encountered.

In 1979, thirteen shallow **(**282' - 500 '***)*** and three intermediate (1,185' - 1,500'**)** depth temperature gradient wells and a 8565' deep exploration test well were drilled by Aminoil USA, Inc. in the vicinity of Leach Hot Springs under a Department of Energy contract to assess the geothermal reservoir (Beard, 1982). A review of the DOE Report including the driller's log for the deep exploratory well shows no mention of encountering H2S during the drilling of that well, indicating a very low probability of elevated H2S levels for the Leach Hot Springs area. The actual amount and ratio of H_2S potentially present in subsurface geothermal fluids cannot be determined until more data is obtained from drilling and the fluids are encountered.

There would be potential for H_2S to be released from an observation well and a production well during flow testing if the well encounters a producible resource. If this occurs, the gas would be vented with the steam and non-condensable gases during testing, which typically lasts three days at each observation well and five days at each production well. However, conditions unique to individual wells may require longer tests or repeated tests at those wells. Emissions of H_2S would be eliminated during drilling through the use of properly weighted drilling mud and installation of BOPE, which would be expected to keep the well from flowing during drilling. Any H_2S gas that could potentially be entrained in the drilling mud and returned with the drilling cuttings to the solid separation process would be expected to be neutralized by the high pH of the mud system. To ensure impacts from emission of H_2S at active drilling locations do not occur, an H_2S monitoring system would be on the drill rigs and the mud tanks to protect workers consistent with the Occupational Safety and Health Administration (OSHA) Safety and Health Regulations (29 CFR 1910.1-1910.1500).

While H_2S is colorless and essentially invisible to the eye, it is readily detectable from its characteristic sulfurous odor. At high concentrations H_2S can be unpleasant to some and can pose a threat to human health. The primary public concern from H_2S emissions is associated with nuisance odors more than concerns related to health. The distinct odor allows the gas to be easily detected at concentrations well below levels of health concern. The closest and only residence within a 5-mile radius of the Project Area is located approximately 3,500 feet west of the nearest proposed well pad. According to the WRCC, prevailing winds most often are in a north and east direction which would carry odors away from the residence and users of Grass Valley Road (WRCC 2010). Furthermore, winds would tend to dissipate and disperse gases over a 3,500-foot distance.

Air Conformity

The project is not located within any non-attainment areas and would not exceed any conformity requirements as dictated in the EPA's rule "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (40 CFR 93, Subpart B). The project is not expected to contribute to any violation of federal ambient air quality standards.

4.2.2 BLM-Recommended Mitigation Measures

No additional mitigation measures have been recommended.

4.2.3 No Action Alternative

Project features would not be constructed under the No Action Alternative; therefore, air quality would not change from existing conditions.

4.3 CULTURAL RESOURCES

4.3.1 Proposed Action

The Project Area does contain one prehistoric site, one historic site, and one isolate find. The prehistoric site consists of a lithic scatter that is recommended eligible for listing on the NRHP. This site was found within the boundaries of the existing mineral material site. An element of the Proposed Action could affect a NRHP property. Taking gravel from the gravel pit could impact the prehistoric site. The historic site and isolate find are recommended not eligible for listing on the NRHP.

The potential exists for buried archaeological components, without a surface manifestation and previously unidentified, to be present in sediments along portions of the Project Area. Should a previously undiscovered cultural resource be discovered during construction of the proposed project, Ormat would implement the environmental protection measures and comply with the applicable lease stipulations described in Section 2.2. These measures include halting all activity near the site and immediately notifying the BLM. Construction would not resume until the BLM provides notification to proceed. Because the proposed project would not impact known historic sites, and because Ormat would implement the environmental protection measures described in Section 2.2 and the mitigation measures listed below; impacts to cultural resources are not anticipated.

4.3.2 BLM-Recommended Mitigation Measures

- Due to Native American religious beliefs concerning springs, it is important that the mitigation recommended in the Water Quality section be implemented.
- If gravel is to be taken from the existing mineral material pit, a boundary fence would be constructed to protect the existing prehistoric site. The boundary fence would be built to the width of the proposed gravel pit and include appropriate signage.

4.3.3 No Action Alternative

The boundary fence would not be constructed under the No Action Alternative. Surface and subsurface disturbance from the existing mineral material pit would continue to occur resulting in impacts the cultural resources at the prehistoric site.

4.4 INVASIVE, NON-NATIVE SPECIES

4.4.1 Proposed Action

The Proposed Action has the potential to increase the spread of noxious weeds and invasive, non-native species. Weed seeds and invasive species seeds can germinate when soils are disturbed by construction activities, particularly where available soil moisture is increased by application of water for dust suppression. Weeds and invasive species could also be introduced by construction equipment brought to the project from infested areas or by the use of seed mixtures or mulching materials containing weed seeds. Prior to travelling within the Project Area, project vehicles would regularly travel on Grass Valley Road and pass roadside occurrences of the noxious weeds, Russian knapweed and tall whitetop. Consequently, seeds from either or both of these species could potentially be transported to and deposited in the Project Area by vehicles. Ormat would implement the environmental protection measures and comply with the lease stipulations described in Section 2.2, which include monitoring for and eradicating species listed on the Nevada Designated Noxious Weeds List (NRS 555.010). With implementation of these measures and stipulations and reclamation of disturbances as described in Section 2.1.8, no lasting impacts associated with invasive, non-native species are anticipated.

4.4.2 BLM-Recommended Mitigation Measures

No additional mitigation measures are recommended.

4.4.3 No Action Alternative

Project features would not be constructed under the No Action Alternative; therefore, the spread of invasive and non-native species associated with the Proposed Action would not occur. Existing roads would continue to remain open for public travel. Such travel would create potential for vehicles to disperse noxious weeds and invasive species.

4.5 MIGRATORY BIRDS

4.5.1 Proposed Action

Approximately 69.79 acres of migratory bird nesting habitat would be disturbed as a result of the Proposed Action. Aside from direct impacts to habitat, increased human activity and noise during construction and drilling in the Project Area could temporarily displace migratory birds.

Most nesting habitat disturbed during construction and drilling would be replaced during reclamation, as described in Section 2.2 and Section 2.1.8. Areas that may remain disturbed would represent permanent impacts to nesting habitat. This impact would be negligible considering these areas represent less than 1 percent of the similar habitat that would remain undisturbed by the project within the Lease Area. Therefore the Proposed Action, when implemented in conjunction with the environmental protection measures described in Section 2.2, would result in minimal impacts to nesting habitat.

Ormat's wells would be operated 24 hours per day during drilling operations, and the well sites would be lighted. The height of the drilling rig derrick would vary depending on the type of exploratory well actively being drilled. During drilling of temperature gradient wells, the top of the drill rig derrick would be from 30 to 50 feet above the ground surface, depending on the rig used. This height may increase to a maximum of 70 feet above ground surface during the drilling of an observation well. The drilling rig derrick could reach heights of 170 feet above ground surface during drilling on a production well. The drilling rigs may represent a collision hazard for night-migrating birds, particularly during adverse weather conditions. Preliminary research suggests red lights may cause disorientation among birds that migrate at night. Red lights on towers seem to disorient migrating birds more than white or green lights (Rich and Longcore 2006). Due to the height of the largest production drill rig derricks (170 feet), FAA regulations require Ormat to utilize red lights. The lights on the drill rig derricks would pulse at the minimum intensity and minimum number of flashes per minute allowable by FAA. All other lights on the Project Area would be down-lit to prevent disorientation among birds.

Fencing of observation and production wells would create additional perches for predatory raptor species. This could result in increased predation, impacting prey species. Impacts would be minimal considering the existing transmission line power poles in the northern part of the Lease Area currently provide perches.

Ormat would comply with the all lease stipulations as described in Section 2.2 in addition to all FAA lighting regulations. Compliance with the lease stipulations, including preconstruction nesting bird surveys if construction occurs during the nesting season, as described in Section 2.2, would minimize impacts to nesting migratory birds and their nests as a result of implementation of the Proposed Action.

4.5.2 BLM-Recommended Mitigation Measures

No additional mitigation measures are recommended.

4.5.3 No Action Alternative

Project features would not be constructed under this alternative; therefore, the disturbance or effects associated with the Proposed Action would not occur.

4.6 NATIVE AMERICAN RELIGIOUS CONCERNS

4.6.1 Proposed Action

Native American consultation is completed and no TCPs or sacred sites have been identified. Although no sites have been identified in the Project Area, the inadvertent discovery of previously unidentified gravesites, cultural properties, artifacts, or similar is possible. If such a discovery is made, Ormat would implement the lease stipulations and environmental protection measures described in Section 2.2. Application of mitigation measures would ensure that Native American Religious Concerns are not impacted by the Proposed Action.

4.6.2 BLM-Recommended Mitigation Measures

- Project-related traffic should be restricted to access roads and well pads.
- Native Americans should be allowed access to TCPs and sacred sites, if discovered.
- Due to Native American religious beliefs concerning springs, it is important that the mitigation recommended in the Water Quality section be implemented.

4.6.3 No Action Alternative

Project features would not be constructed under the No Action Alternative; therefore, the disturbance or effects associated with the Proposed Action would not occur.

4.7 WASTES, HAZARDOUS AND SOLID

4.7.1 Proposed Action

Diesel fuel, lubricants, hydraulic fluids, and drilling chemicals (drilling mud, caustic soda, barite, etc.), would be transported to, stored on, and used in the Project Area during exploration activities. The project would comply with both federal and state requirements for handling and storing hazardous materials. Typical of most construction projects, the storage and use of these materials could result in minor, incidental spills of diesel fuel or oil during fueling of equipment, filling of fuel storage tanks, and handling of lubricants. Other incidental spills could be associated with equipment failures such as ruptured hoses.

Prior to exploration and development, an emergency response plan would be developed that includes a hazardous material spill and disposal contingency plan. The emergency response plan would describe the methods for cleanup and abatement of any petroleum, hydrocarbon, or other hazardous material spill. The emergency response plan would be submitted to the BLM for approval and made readily available on-site before commencement of operations in accordance with the lease stipulations. Secondary containment structures would be provided for all chemical and petroleum/oil storage areas during drilling operations. Additionally, absorbent pads or sheets would be placed under likely spill sources and spill kits would be maintained on site during construction and drilling activities to provide prompt response to accidental leaks or spills of chemicals and petroleum products. All equipment and machinery would be maintained free of oil or other fluid leaks.

Small quantities of solid wastes (paper, plastic, and other garbage) generated by the Proposed Action would be transported off-site to an appropriate landfill facility. Any hazardous wastes

generated on-site would be properly stored on-site and later properly disposed of at an approved facility that accepts hazardous wastes. Portable chemical toilet wastes would be removed by a local contractor. Small quantities of hazardous waste would be generated by construction operations. Typically these wastes would be in the form of empty drums or spent lead acid batteries used for construction equipment. Construction activities typically generate waste oils, oily rags, and oil-impregnated absorbent materials used to clean up minor spills from construction equipment. Most waste generated from the construction activities would be solid (non-hazardous) waste.

Well stimulation operations may involve placing a dilute mixture of hydrochloric (muriatic) acid down the well under pressure to dissolve mineral crystals in the geothermal reservoir that inhibit the flow of geothermal fluids. Concentrated hydrochloric acid (35 percent) would be trucked to the site per occurrence and mixed on-site with water by experienced contractors (hydrochloric acid would not be stored on-site) in accordance with federal and state regulations as applicable which would prevent any leaks and spills of the acid. As the acid would be pushed under pressure down the well bore with water and out into the reservoir, it would react chemically with the minerals and would be neutralized. The acid would also be diluted as it mixes with the geothermal fluid and the water that is used to push the acid into the reservoir rock. The volume of acid used would be infinitesimal compared with the volume of the reservoir fluid, and any potential impacts to reservoir fluid chemistry would be localized, and temporary. After dissolving the minerals in the geothermal reservoir, the water and spent acids would be forced by the higher reservoir pressure back to the lower pressure well bore and they would be flushed out of the reservoir rock. As the acid and water would be circulated back to the surface inside the well bore, the well casing would protect any water zones higher in the well bore from potential contamination by the spent acid. At the surface, the spent acid and injected water would be tested, neutralized if necessary (using sodium hydroxide, crushed limestone, or marble) to eliminate any potential impacts of the acid, and discharged to the well pad reserve pit where it would evaporate.

4.7.2 BLM-Recommended Mitigation Measures

No additional mitigation measures are recommended.

4.7.3 No Action Alternative

Project features would not be constructed under the No Action Alternative; therefore, impacts to hazardous and solid waste would not occur.

4.8 WATER QUALITY (SURFACE/GROUND)

4.8.1 Proposed Action

The Proposed Action would permit Ormat to construct 12 well pads and approximately 10,750 feet of access road and to improve about 7,400 feet of existing access road. During construction of the project, topographic drainages would be avoided to the extent possible, and rolling dips would be used when drainages must be crossed by access roads. Additionally, Ormat would implement BMPs and environmental protection measures during construction. Protection

measures include restoring pre-construction contours and seeding disturbance following construction.

Although there are no springs located within the Lease Area, Leach Hot Springs, which are potentially connected to the geothermal reservoir, are located immediately down-gradient and adjacent to the Lease Area.

Implementation of protection measures and lease stipulations would reduce or prevent potential impacts to surface water quality within the drainages and the adjacent springs.

Well testing would involve removing thermal groundwater and discharging it to the drill pad reserve pit. Production well testing is anticipated to result in the largest flow volume (approximately 155 gallons per minute) and duration (average of 5 days). This would result in up to 1.1 million gallons of groundwater being extracted from the geothermal aquifer for each production well during testing. Geothermal groundwater could percolate to groundwater aquifers from the reserve pits. To reduce potential reserve pit percolation, Ormat would utilize bentonite clay during drilling. The bentonite would settle in the reserve pits during drilling and form a nearly impenetrable clay liner.

There is a potential for hydrologic connection between the geothermal aquifer and the shallower groundwater aquifer that feeds surface water features such as springs. Typically, geothermal aquifers and shallow groundwater aquifers are not believed to be hydrologically connected, except in localized areas where preferential pathways may have formed associated with historical tectonic activity (e.g., Leach Hot Springs). Where this has occurred, deeper geothermal fluids are modeled by researchers to have risen and mixed with shallower non-thermal groundwater and/or discharge to the ground surface as hot springs. While it is not possible to categorically exclude this possibility based on available data, there is also insufficient data at Leach Hot Springs to reasonably characterize and understand the nature and scope of any such possible connection. It is therefore not possible to accurately describe any potential impacts to surface and groundwater systems from the proposed action.

If there were a direct hydrologic connection between the geothermal aquifer and shallow groundwater, then temperature or quantity of spring water could potentially be affected through the withdrawal of geothermal fluids during drilling and well testing. In this case, withdrawal of fluid from the geothermal reservoir, which would be expected to be at a much higher temperature than the shallow groundwater, could potentially reduce the thermal inflow component of the shallow aquifer and thereby lower its temperature, as well as potentially the volume, at groundwater discharge points such as springs. Drilling mud density and weight are managed to minimize entry of natural fluids into the well bore in order to maintain mud circulation and thereby control of the well. In addition, once casing strings are cemented in the hole as drilling progresses, they would seal off any natural flow into the well bore. Well testing would withdraw geothermal reservoir fluids, but the duration of such tests and the volume of fluid involved would be minor compared with the volume of natural geothermal reservoir fluids and shallow

groundwater and would potentially have only a minor impact, if any at all. To minimize or completely avoid these impacts, environmental protection measures for well installation and testing would be implemented as described in Section 2.2.

The Proposed Action would authorize vertical drilling through the earth to depths as great as approximately 6,000 feet below ground surface. This would result in various shallow alluvial aquifers, as well as the geothermal aquifer being penetrated by the drill bit. The drill hole would connect shallow alluvial aquifers, which could potentially be connected to Leach Hot Springs. Drilling would also connect shallow aquifers with the geothermal aquifer, which in turn could affect the water temperature in the aquifers and thus potentially at the springs. In order to prevent the drill holes from essentially connecting previously unconnected aquifers, Ormat would implement a BLM-approved cementing and casing program for the drilling of exploration wells. Casing (i.e., lining) the entire length of each exploratory drill hole would provide a seal that isolates the geothermal aquifer from shallow alluvial aquifers. Ormat would maintain borehole geophysics analyses (cement bond logs) to document that well casing and cementing activities provide an effective seal isolating the geothermal aquifer from shallow alluvial aquifers. Because of these measures, impacts to Leach Hot Springs and the associated riparian area as a result of aquifer mixing are not anticipated.

Typically, several short-term flow tests lasting 2 to 4 hours and one or more long-term flow tests would be performed at each production well upon completion of drilling. Each long-term flow test would typically last approximately 5 days. Assuming a production well is drilled and tested at all of the 12 proposed well pads, long-term flow tests would last approximately 60 days total. Although Ormat may drill as many as two exploratory wells concurrently within the Project Area, only one production well would be drilled at any time. Each production well would require approximately 45 days to drill. Therefore, long-term flow tests would occur in increments of approximately 5 days that are separated by approximately 45-day periods of no testing, until approximately 60 days of testing are completed.

Based on the results of the short term flow test well stimulation may be performed. Refer to section 4.7.1 for the impact analysis associated with well stimulation operation. Pumping groundwater over these short increments would not be anticipated to affect water quantity at Leach Hot Springs.

Project-related water would be obtained from no more than two non-potable groundwater wells. Each well would be temporary and located on any one of the 12 pad sites; therefore, no additional surface disturbance would be associated with the drilling of the groundwater well(s). The wells would be permitted under a geothermal waiver by the NDWR and approved by the BLM. The wells would be drilled down to a productive interval of sands, gravels, or fractures (estimated at approximately 500 feet). While the groundwater basin has been “designated” by the State Engineer, Ormat’s proposed water wells would qualify for a “designated” exemption.

As an alternative, water needed for construction and drilling operations could also be purchased and trucked from nearby agricultural ranches and sources on private land. Should Ormat acquire water through this alternative, a purchase agreement from the water rights owner and a temporary use permit from the NDWR would be obtained prior to acquisition of the water. Assuming a typical 2,500-gallon capacity water truck is used to transport water, as many as 12 trips per day would be required during drilling of an observation or production well. If two wells are actively drilled simultaneously, as many as 24 trips per day could occur. Water trucks would remain on existing roads and would be maintained to prevent oil and petroleum leaks. Water trucks would typically travel slower than posted speed limits, which would reduce fugitive dust emissions from the unpaved road surface. Additionally, water trucks would be used to apply water to access roads and well pads to control fugitive dust. Aggregate would be applied to proposed access roads as needed and would further serve to reduce fugitive dust. The remote nature of the Project Area and lack of existing traffic on Grass Valley Road limit the potential impacts resulting from 24 additional trips per day. Other impacts from transporting water would be minimal to unnoticeable and temporary for the duration of drilling, which is anticipated to be less than 5 years. These impacts may include noise emissions from truck engines and travel and localized vibration during travel when weighed with water.

4.8.2 Surface and Groundwater Monitoring Plan

As the boreholes for groundwater and geothermal wells are advanced, the depth of aquifers (non-thermal and thermal) penetrated during drilling would be noted. An assessment of whether the aquifer(s) is/are confined or unconfined would be made, as well as an estimate of aquifer thickness, a qualitative assessment of its relative productivity and water quality. The temperature of a penetrated aquifer(s) would also be noted.

4.8.3 BLM-Recommended Mitigation Measures

Leach Hot Springs are located on private property immediately downstream and adjacent to the Lease Area. Due to their proximity, they appear to be potentially connected to the proposed action with the potential that development of the geothermal reservoir could impact them. Adverse impacts to surface expressions of the geothermal reservoir (hot springs) are not acceptable. With the permission of the water rights owner, the lessee will monitor the quality, quantity, and temperature of Leach Hot Springs as follows:

- Prior to commencement of exploration activities, the operator should institute a BLM approved water monitoring program.

4.8.4 No Action Alternative

Project features would not be constructed under the No Action Alternative; therefore, water quality would not change from existing conditions.

4.9 PALEONTOLOGICAL RESOURCES

4.9.1 Proposed Action

Implementation of the Proposed Action could result in impacts to paleontological resources, particularly during well drilling, excavation of reserve pits, and other activities requiring subsurface disturbances. The Project Area is located on an alluvium-covered pediment, and these geologic landforms are generally not fossil-bearing in the Great Basin. The Project Area possesses a PFYC of 3, or moderate potential. Areas of PFYC 3 designation are known to contain vertebrate fossils or scientifically significant invertebrate fossils, but these occurrences are widely scattered. Common invertebrate or plant fossils may be found in the area. The potential for a project to be sited on or impact a significant fossil locality is low but is somewhat higher for common fossils. Should a previously unknown paleontological resource be discovered during construction or drilling, Ormat would comply with lease stipulations and implement the environmental protection measures described in Section 2.2. Therefore, the Proposed Action would not be anticipated to have effects on paleontological resources.

4.9.2 BLM-Recommended Mitigation Measures

No additional mitigation measures are recommended.

4.9.3 No Action Alternative

Under the No Action Alternative no subsurface ground disturbance would occur and, as a result, paleontological resources would not be affected.

4.10 GEOLOGY AND MINERALS

4.10.1 Proposed Action

The potential for induced seismicity in the Grass Valley fault zone is not known. By the geologic nature of geothermal systems, they are located in actively seismic and/or volcanic areas. This can make it very difficult to distinguish seismic activity that is naturally occurring in the area from that which may be induced by geothermal operations. There have been examples of induced seismicity resulting from a variety of human activities, including the production and injection of geothermal fluids for some long-term geothermal power plant operations. The associated seismic activity has occurred in the form of "micro-earthquakes" with a Richter Scale magnitude of 3 or less, which is not detectable to humans (Jennejohn, Blodgett, and Gawell 2009). A history of recent (1954) earthquakes and the presence of hot springs on the surface trace of the Pleasant Valley fault zone, which is located south of Grass Valley, is indicative of relatively high potential for induced seismicity if injection of geothermal fluids into deep wells occurs (Ryall and Vetter 1982). Induced seismicity would not be expected to occur at the minimal rates of injection for exploration.

The Proposed Action does include the possibility of conducting short duration injectivity tests to determine whether the naturally occurring fractures in the reservoir would accept spent geothermal fluids. However, a short duration injectivity test in a single well is at a significantly smaller scale than long-term and continuous injection of spent geothermal fluids in multiple wells during commercial production operations.

The short duration and very localized nature of the injectivity tests would not be anticipated to result in any induced seismic events, and impacts to geology would not be anticipated.

The geothermal resource, considered to be a fluid mineral by the BLM, would be targeted by drilling up to three types of exploratory wells at as many as 12 well pad locations. The geothermal resource would be tested temporarily if drilling results are successful. There are no active mining claims located in the vicinity of the Lease Area. The Proposed Action would not be expected to impact minerals or mineral extraction activities.

4.10.2 BLM-Recommended Mitigation Measures

No additional mitigation measures are recommended.

4.10.3 No Action Alternative

In the No Action alternative, there would be no effect on any of the existing geologic features in the area. No mineral resources, including geothermal, would be affected.

4.11 SOILS

4.11.1 Proposed Action

The Proposed Action includes removal of up to 69.79 acres of vegetative cover through earth-moving activities such as grading and excavation. These types of activities would leave soils exposed to wind and water, two key components of erosion. The potential for erosion is somewhat reduced by the naturally occurring topography of the site. The gentle slopes typical of the Project Area make movement of soil particles less likely. In order to ensure erosion is minimized and soil loss is prevented, Ormat would implement the environmental protection measures described in Section 2.2. These protection measures include BMPs that prevent erosion and capture mobilized soil particles (sediment). Disturbances would be reclaimed as described in Section 2.1.8. Assuming 12 inches of topsoil are salvaged, approximately 112,594 cubic yards of topsoil would be salvaged and stored on the well pads during construction and reused whenever possible and in a timely manner. The reclaimed areas would be planted with the seed mix presented in Table 5. Once established, the vegetation would hold surface soils intact and weaken the likelihood of erosion. Additionally, 69.79 acres represents approximately 1 percent of the total area of soil and vegetation within the Lease Area, which is more than 5,200 acres.

The release of hazardous materials onto the ground surface could affect soil resources. Ormat would comply with lease stipulations and implement environmental protection measures specified in Section 2.2 specific to hazardous waste spills and cleanup. These stipulations include development of a hazardous material spill and disposal contingency plan, and placement of absorbent pads atop soils that are located under likely spills. The stipulations and environmental protection measures would lessen potential impacts to minimal.

4.11.2 BLM-Recommended Mitigation Measures

No additional mitigation measures are recommended.

4.11.3 No Action Alternative

The No Action Alternative would not result in surface disturbances that would expose soils and increase the potential for erosion. No hazardous wastes or other material would be brought to or stored at the Project Area, and therefore there would be no potential for spills onto the soil surface or subsurface. The existing environment for soils would remain unchanged under this alternative.

4.12 VEGETATION

4.12.1 Proposed Action

Implementation of the Proposed Action would result in the removal of approximately 69.79 acres of vegetation within the 160-acre Project Area. The majority of this habitat is mixed salt desert scrub, but up to approximately 5.2 acres of sagebrush habitat may be removed as well. Direct impacts to vegetation would result from constructing new access roads and well pads, expanding the existing mineral material site, and repairing existing access roads. Drilling rigs, construction equipment, and vehicles could crush or damage vegetation. Similar vegetation types surround the Project Area, including more than 5,200 acres of additional vegetation within the Lease Area. The BLM has expressed concern about impacts to sagebrush habitat in the area, as these habitats may be used by mule deer and several BLM sensitive species. Approximately 12 percent of the 160-acre Project Area is sagebrush habitat, the majority of which occurs in drainages. The proposed drill sites and access road alignments include buffers that would allow Ormat to locate roads and drill sites in locations that would minimize impacts to sagebrush. Ormat has also stated they would avoid impacts to drainages to the extent practicable. Ormat would implement protection measures and comply with lease stipulations that include reclaiming the Project Area. These stipulations would ensure impacts would be minimal. According to the lease stipulations, reclamation would be implemented within two years of project completion. Therefore, impacts would also be minimal for the maximum five-year construction and drilling period and the following reclamation period. Reclamation would include planting sagebrush seedlings in impacted sagebrush habitat.

Vegetation could be indirectly affected by soil compaction resulting from site grading, clearing, and other ground-disturbing activities during operation of the Proposed Action. Additionally, cleared areas would be susceptible to establishment of invasive vegetation which could potentially out-compete native vegetation. Ormat would, however, comply with the lease stipulations and implement the environmental protection measures described in Section 2.2. These stipulations and measures include salvage of topsoil, which would reduce the effects of soil compaction during reclamation, and requirements for "certified" weed-free seed mixes.

The proposed disturbance to 69.79 acres of vegetation is relatively minor considering the abundance of similar vegetation nearby. No decrease in any plant population or community below self-sustaining levels would occur as a result of implementing the Proposed Action.

4.12.2 BLM-Recommended Mitigation Measures

- Sagebrush seedlings would be required in disturbed sagebrush habitat. Density of seedlings should be 0.25 per meter square (1 seedling per 4 meters), or 1,000 seedlings per acre. Seedlings would be planted between February 15 and April 1.

4.12.3 No Action Alternative

Project features would not be constructed under the No Action Alternative; therefore, the disturbance to vegetation associated with the Proposed Action would not occur.

4.13 WILDLIFE

4.13.1 Proposed Action

Wildlife and wildlife habitat would be directly and indirectly impacted by implementation of the Proposed Action. Construction of the drill pads and access roads and expansion of the mineral material site would result in the removal of approximately 69.79 acres of wildlife habitat. Disturbances may continue for the duration of drilling and persist through the establishment of reclaimed vegetation. Construction and drilling activities are anticipated to last between one and five years, and lease stipulations require reclamation of disturbed areas to occur within two years of project completion. Generally, revegetation would be expected to be considered successful after three years from the date reclamation occurred. During this period, wildlife would be expected to either temporarily or permanently relocate to similar undisturbed habitat near the Project Area. Because disturbed habitat would be reclaimed and similar habitat is available nearby, impacts to most wildlife habitat would be minimal.

Activity in the Project Area may inhibit local wildlife movement between valuable habitat to the east of the Project Area and Leach Hot Springs. Conversation with NDOW suggests deer use of the springs as a water source is probably low, but antelope and other species may use flow below the springs as a source of water (personal communication, Kyle Neill). Sagebrush habitats east of the Project Area are identified as important mule deer winter range, with most use probably occurring in the late winter. The area may also be used by mule deer during years of heavy snow accumulation (personal communication, Kyle Neill). The sagebrush habitats east of the Project Area are of particular importance because similar habitat to the north and south has been lost to wildland fires. Actual patterns of mule deer use in the area are uncertain. Disturbance to occupied mule deer habitat may induce stress in deer wintering in or near the Project Area and may increase competition for forage, cover, and other resources in adjacent habitats. Depending on the degree of stress, affected animals may suffer weight loss and reduced health, and may miscarry. Deer may also suffer increased predation, particularly if animals move into unfamiliar territory. Disturbance that causes stressed animals to concentrate in an area can also increase the potential for disease transmission. To mitigate for the potential impacts to mule deer use, operations within the areas mapped as crucial winter habitat for mule deer would not be permitted between December 15 and March 15. Should additional data be collected to determine actual mule deer use within the Project Area, these dates may be modified or eliminated entirely. Such modifications would be made by the BLM in consultation with the NDOW.

No perennial or intermittent surface waters exist in the Project Area, and the Proposed Action is not expected to affect off-site surface waters. The single drainage that USGS mapping indicates flows to the Leach Hot Springs area from near the eastern part of the Project Area begins approximately 0.2 mile west of the proposed drill pads in T32N, R39E, section 31. Other mapped drainages in the area flow either north or south of the hot springs. The quality of wildlife watering areas, including the Leach Hot Springs, would therefore not be impacted by road or drill pad construction.

The well pad locations and roads proposed in T32N, R39E, section 31, are within crucial mule deer winter range habitat as mapped by the NDOW. These proposed wells are located along the western boundary of this mapped habitat. The NDOW recommends avoidance of crucial mule deer winter range habitat in T32N, R39E, sections 32 and 33, and in T31N, R39E, section 5 (Appendix C), the three sections immediately south and east of the proposed Section 31 well sites. No portion of the Project Area is located within either of these three sections. Sagebrush habitat, a potential food source for wintering deer, exists primarily in drainages in the Project Area. A survey of sagebrush habitat in the Project Area indicates that approximately 12 percent of the Project Area is sagebrush habitat. Based on the sagebrush survey, up to approximately 5.2 acres of such habitat would be impacted if all 69.79 acres of the Project Area were disturbed.

Direct impacts from mortality to smaller, less mobile wildlife species could occur during construction. Such mortality would be expected to occur infrequently as construction would progress in a generally linear path along the access roads and eventually reach well pads. Wildlife that occur in the access road alignments or well pad locations would be expected to vacate the area prior to construction machinery reaching their locations. Ormat would implement the environmental protection measures described in Section 2.2 to reduce potential vehicular collisions with wildlife. Noise, human presence, and heavy equipment use during construction activities are likely to temporarily displace wildlife that may be present in or near the Project Area. This could have an indirect effect on wildlife species in the area. These indirect effects could reduce breeding success of species that are sensitive to human activity. These impacts are expected to be temporary and short term for the duration of the proposed construction and drilling activities. These activities would continue for up to approximately 16 days for temperature gradient wells and for up to approximately 90 days for production wells. As required by stipulations attached to the leases, reclamation of all disturbances in the area would be performed within two years unless a developable resource is identified. If such a resource is identified, any proposed further development of the resource would be subject to additional environmental review. The proposed environmental protection measures would prevent personnel and drill crews from intentionally harassing or interacting with wildlife.

Fencing of observation and production wells would create additional perches for predatory raptor species. This could result in increased predation, impacting prey species. Impacts would be minimal considering the existing transmission line power poles in the northern part of the Lease Area currently provide perches.

When implemented with environmental protection measures and mitigation measures, no population-level impacts to wildlife species are expected as a result of the Proposed Action. Wildlife impacts are expected to be temporary and minimal.

4.13.2 BLM-Recommended Additional Mitigation Measures

- To mitigate for the potential impacts to mule deer use, operations within the areas mapped as crucial winter habitat for mule deer would not be permitted between December 15 and March 15. Should sufficient additional data be collected to determine actual mule deer use within the Project Area, modifications to these dates could be made by the BLM in consultation with the NDOW. The seasonal restriction for crucial mule deer winter habitat also applies to wintering sage-grouse.
- Sagebrush seedlings would be required in disturbed sagebrush habitat. Density of seedlings should be 0.25 per meter square (1 seedling per 4 meters), or 1,000 seedlings per acre. Seedlings would be planted between February 15 and April 1.

4.13.3 No Action Alternative

Project features would not be constructed under the No Action Alternative. Therefore, construction of access roads and well pads would not take place, and the resulting loss of wildlife habitat would not occur.

4.14 RANGELAND MANAGEMENT

4.14.1 Proposed Action

The Proposed Action would disturb about 69.79 acres. This is a very small percentage of the 168,086 acres (approximately 0.0004 percent) within the Clear Creek and Dolly Hayden Allotments. Impacts to vegetation would be minimized by reseeding all areas of access roads and well pads not required for subsequent energy production. Impacts to livestock grazing in the Clear Creek and Dolly Hayden Allotments would be negligible.

All proposed exploration activities are located away from water sources and would not prevent livestock from watering. To prevent cattle from accessing areas which might be harmful to them, Ormat would install fencing around pits in conformance with the Gold Book and has not proposed any project activities which would substantially limit livestock's access to the undisturbed portions of the Lease Area. Direct and indirect impacts to livestock would be reduced as a result of implementation of the Proposed Action.

Any BLM authorized modifications to the existing Grass Valley Road fence, including cattleguards and/or gates, would require coordination with BLM to determine if they would be returned to original condition.

4.14.2 BLM-Recommended Mitigation Measures

No additional mitigation measures are recommended.

4.14.3 No Action Alternative

Project features would not be constructed if the No Action Alternative is selected, so there would be no impacts to livestock and rangeland management.

4.15 RECREATION

4.15.1 Proposed Action

Recreational use of the Project Area is likely minimal based on the lack of established facilities and natural features that would tend to attract substantial numbers of recreationists. While there would be the occasional inconvenience of increased project-related traffic on existing roads that would be used for access, implementation of the Proposed Action would not prevent or prohibit use of these roads or use of public lands. Because recreation in the area is minimal and access would not be restricted by the Proposed Action, no impacts are anticipated to recreation.

4.15.2 BLM-Recommended Mitigation Measures

No additional mitigation measures are recommended.

4.15.3 No Action Alternative

Project features would not be constructed under the No Action Alternative; therefore, recreation opportunities would not change from existing conditions.

4.16 VISUAL RESOURCES

4.16.1 Proposed Action

Visual impacts resulting from implementation of the Proposed Action would be anticipated to be minimal and are in conformance with the objectives of BLM VRM Class IV. Impacts to visual resources would occur during road and well pad construction activities as a result of the presence of drill rigs, drill crew vehicles and camps, and accessory construction equipment. The well pads and new access roads would be at ground level and would not affect visual resources. Proposed access roads would contribute only similar elements to the existing landscape since there are numerous roads in existence within the Lease Area and vicinity.

During drilling operations, the drill rig mast could extend up to 170 feet above the ground surface. These operations would be conducted 24 hours per day, 7 days per week, for a period of what is typically 45 days. The rig would be visible at distances of greater than 1 mile from the drill site, and lights used when drilling at night would increase rig visibility. The drill rigs would be present for the duration of drilling. Ormat would implement the environmental protection measures described in Section 2.2 to reduce lighting impacts and degradation of dark sky resources. These measures include limiting lighting to where needed for safe operations and shielding or directing lights to the immediate work area.

4.16.2 BLM-Recommended Mitigation Measures

No additional mitigation measures have been recommended.

4.16.3 No Action Alternative

Project features would not be constructed under the No Action Alternative; therefore, visual resources would not change from existing conditions.

4.17 LAND USE AUTHORIZATION

4.17.1 Proposed Action

The Proposed Action would occur within existing ROWs for overhead transmission lines and ROWs for an existing mineral material site. The mineral material site is located in T31N, R38E, section 1, which is within the Lease Area and the Project Area. The existing mineral material site would be expanded by as many as 10 acres by Ormat in order to allow for extraction of gravel for the proposed project. This expansion would also ensure that the mineral material site continues to provide an adequate volume of gravel for the needs of Pershing County, who holds a Free Use Permit ROW (N-79708) for the site. The BLM also holds a Free Use Permit ROW (N-81087) for the mineral material site, and Ormat would enter a mineral material sales contract with the BLM for gravel from the site. The ROWs for the overhead transmission lines include unpaved roads underneath and roughly aligned with the overhead transmission lines. Ormat would partially access the four northernmost proposed well pad locations by utilizing a segment of one of these existing roads. The transmission line ROW's are held by NV Energy. No impact to the transmission lines or rights granted to NV Energy in its ROW would be impacted, however, due to implementation of the environmental protection measures listed in Section 2.2. These measures prohibit drilling activities from occurring within existing ROWs. These measures also include notifying all ROW holders in the area of the project and obtaining the location of any underground utilities if applicable. These measures, as well as the design of the project, would prevent impacts to land use authorizations.

Daily operation of the Proposed Action would result in up to 18 additional vehicles trips on Grass Valley Road. Increased vehicle trips on Grass Valley Road would be temporary for the duration of drilling, which is typically 45 days per production well and fewer for other well types. Due to remoteness of the Project Area and generally light use of Grass Valley Road, a temporary increase in traffic of 18 trips per day would not be anticipated to adversely impact traffic.

Current uses of the Lease Area and vicinity include grazing and dispersed recreational use consisting primarily of occasional hunting activities and recreational shooting. Ormat would maintain existing roads within the Project Area that are used for access to well pads and the mineral material site and would not restrict public use of these roads or access to public lands. Therefore the Proposed Action would not impact land use or access.

4.17.2 BLM-Recommended Mitigation Measures

No additional mitigation measures have been recommended.

4.17.3 No Action Alternative

Project features would not be constructed under the No Action Alternative; therefore land use would not change from existing conditions.

4.18 SPECIAL STATUS SPECIES

4.18.1 Proposed Action

Construction of the proposed access roads, well pads, and mineral material site expansion would disturb up to 69.79 acres of foraging habitat by direct removal of the vegetative cover. Construction would also increase human activity in the area, which in turn would reduce the availability of prey in the area. Sensitive predatory species potentially affected by a locally reduced prey base include the golden eagle, ferruginous hawk, burrowing owl, and loggerhead shrike. Most impacts to foraging habitat would be for the duration of construction and drilling through reclamation. Disturbed areas not needed for active support of operations would undergo reclamation as soon as practical. Additionally, Ormat would use existing access roads to the extent feasible to reduce new impacts to vegetative cover.

Burrowing owl habitat would be impacted by construction activities occurring in the open habitats of the Project Area. Implementation of the environmental protection measures and compliance with the lease stipulations described in Section 2.2 would minimize impacts to burrowing owl. Specifically, Ormat would have pre-construction nesting migratory bird surveys performed prior to disturbance during the migratory bird nesting season (March to July). This would ensure that owls and their burrows are not disturbed by construction during this period. The stipulations and protection measures would minimize impacts to other migratory bird species that may occur in the Project Area as well.

Although the well pad locations and associated access roads proposed in T32N, R39E, section 31, are within the limits of the Sonoma PMU for sage-grouse, limited sagebrush occurs within the Project Area. The sagebrush that does occur within the Project Area is generally confined to topographic drainages that traverse the Project Area. These stringers of sagebrush were searched for evidence of sage-grouse and pygmy rabbits in both April and August 2010. No evidence of either species was found in or immediately adjacent to the Project Area. Should either of these species occur within the Project Area, compliance with the Lease Stipulations and implementation of the environmental protection measures described in Section 2.2 would minimize impacts to these species. The temporal restrictions applied to minimize impacts to wintering mule deer would also apply to wintering sage-grouse. Specifically, since critical mule deer winter range and sage-grouse winter range are similar, operations within the areas mapped as crucial winter habitat for mule deer and wintering sage-grouse would not be permitted between December 15 and March 15.

The NDOW noted that although there is no resident bighorn sheep population in this area, bighorn sheep do move through the area. No evidence of bighorn sheep were observed during several site visits. Impacts to bighorn sheep are not anticipated to occur.

As noted in section 4.13.1, fencing of observation and production wells would create additional perches for predatory raptor species, including golden eagles and hawks. This could result in increased predation, impacting prey species. Impacts would be minimal considering the existing transmission line power poles in the northern part of the Lease Area currently provide perches.

This would be a positive impact for foraging raptors, but the increased predation would impact terrestrial species of prey and nesting birds. Impacts would be minimal considering the existing transmission line power poles in the northern part of the Lease Area currently provide perches.

The Proposed Action would generate effects that extend beyond the Project Area, such as increased noise during construction and visual alterations. An access road would be constructed within one-quarter mile of an active ferruginous hawk nest located in the Project Area. Construction noise could impact this nest (if it is an active nest) and result in the hawk permanently or temporarily deserting the site.

A number of BLM special status bat species may forage in the Project Area. Most foraging probably occurs near the open water sites of Leach Hot Springs, west of the Project Area. Some foraging is expected to occur in the Project Area, however, and the presence of lighted drill rigs would attract insects, which would in turn attract bats. Bats, with their sonar abilities, would be expected to easily detect and avoid drill rigs while foraging. The Proposed Action is not expected to adversely affect bats.

4.18.2 BLM-Recommended Mitigation Measures

- Should construction or drilling occur within a one-half mile distance of an active raptor nest, including the known ferruginous hawk nest in the Project Area, construction shall be delayed until any young birds have fledged from the nest. Should raptors begin to nest in the Project Area after the initiation of drilling, the birds would be considered habituated to the disturbance and drilling could continue.
- Sagebrush seedlings would be required in disturbed sagebrush habitat. Density of seedlings should be 0.25 per meter square (1 seedling per 4 meters), or 1,000 seedlings per acre. Seedlings would be planted between February 15 and April 1.

4.18.3 No Action Alternative

Project features would not be constructed under this alternative; therefore, the disturbance or effects associated with the Proposed Action would not occur.

4.19 WETLANDS AND RIPARIAN ZONES

4.19.1 Proposed Action

The Proposed Action would not be anticipated to directly impact wetlands or riparian areas. There are no wetlands or riparian areas within the limits of the Project Area, but the Leach Hot Springs are located immediately adjacent to and down-gradient of the Project Area. There are wetlands and riparian areas associated with the Leach Hot Springs. Although all new surface disturbances would occur within the Project Area, surface disturbance within the Project Area would require drilling

fluid and petroleum products and would result in bare soils that would be subject to increased erosion potential. In order to prevent erosion and the indirect impact of sediment-laden runoff from the Project Area from reaching Leach Hot Springs and the associated riparian areas, Ormat would implement the environmental protection measures described in Section 2.2. These measures include installing BMPs such as silt fencing or certified weed-free straw bales that slow runoff and allow suspended sediment to settle or filter out. Ormat would also utilize bentonite in the drilling mud to allow reserve pits to form a nearly impermeable layer to retain drilling fluids. This would prevent the drilling fluids from flowing from the well pads into drainages where it may flow to Leach Hot Springs and/or the associated riparian areas.

Indirect impacts to wetlands or riparian areas should be minimized due to the environmental protection measures described in Section 2.2.

If implemented, the Proposed Action would authorize vertical drilling through the earth to depths as great as approximately 6,000 below ground surface. This would result in various shallow alluvial aquifers, as well as the geothermal aquifer, being penetrated by the drill bit. The drill hole would connect shallow alluvial aquifers, which could potentially be connected to Leach Hot Springs. Drilling would also connect shallow aquifers with much warmer geothermal aquifers, which in turn could affect the water temperature in all aquifers and thus potentially indirectly impact the springs. In order to prevent the drill holes from essentially connecting previously unconnected aquifers, Ormat would implement a BLM-approved cementing and casing program for the drilling of exploration wells. Casing (i.e., lining) the entire length of each exploratory drill hole would provide a seal that isolates the geothermal aquifer from shallow alluvial aquifers. Ormat would maintain borehole geophysics analyses (cement bond logs) to document that well casing and cementing activities provide an effective seal isolating the geothermal aquifer from shallow alluvial aquifers. Because of these measures, impacts to Leach Hot Springs and the associated riparian area as a result of aquifer mixing are not anticipated.

Typically, several short-term flow tests lasting 2 to 4 hours and one or more long-term flow tests would be performed at each production well upon completion of drilling. Each long-term flow test would typically last approximately 5 days. Therefore, long-term flow tests would last approximately 60 days total for all 12 production wells. Although Ormat may drill as many as two exploratory wells concurrently within the Project Area, only one production well would be drilled at any time. Each well would require approximately 45 days to drill. Therefore, long-term flow tests would occur in increments of approximately 5 days that are separated by approximately 45-day periods of no testing, until approximately 60 days of testing are completed. Pumping groundwater over these short increments would not be anticipated to affect water quantity at Leach Hot Springs to the extent that the associated riparian area is impacted.

Ormat would also comply with the lease stipulations that are listed in Section 2.2 and provided in Appendix A. The stipulations provided for additional reassurance that wetlands and riparian areas would be protected from impacts resulting from the Proposed Action.

4.19.2 BLM-Recommended Mitigation Measures

No additional mitigation measures have been recommended.

4.19.3 No Action Alternative

Project features would not be constructed under the No Action Alternative; therefore, Leach Hot Springs and the associated wetland would not change from existing conditions as a result of activities within the Lease Area.

4.20 NOISE

4.20.1 Proposed Action

There are very few residential dwellings, places of public assembly, or other noise receptors within the vicinity of the Project Area. Only one residential structure is known to exist within a 5-mile radius of the Project Area. This residence is approximately 3,500 feet west of the Project Area. As described in Section 3.20, the loudest noise from the project would produced during well testing. During testing, noise would be emitted at approximately 83 decibels when heard from 50 feet. The well-testing noise would attenuate to approximately 46 decibels before reaching the residence. A noise of 46 decibels is quieter than rainfall (Dangerous Decibels 2001), and not uncomfortable for human hearing (National Institute of Deafness and Other Communication Disorders 2010). Assuming 12 wells of each type are drilled, noise from the proposed drilling would occur for an approximate duration of 816 days. In order to protect the drilling crew and personnel from exposure to loud noise and reduce the total noise emissions of the project, Ormat would implement the environmental protection measures listed in Section 2.2.

4.20.2 BLM-Recommended Mitigation Measures

No additional mitigation measures have been recommended.

4.20.3 No Action Alternative

Project equipment and noise producing activities would not be operated under the No Action Alternative; therefore, existing ambient noise in the area would not be changed.

CHAPTER 5
CUMULATIVE IMPACTS ANALYSIS

5.1 CUMULATIVE IMPACTS ASSESSMENT AREA

Cumulative impacts have been defined under 40 CFR 1508.7 as:

"The impact which results from the incremental impact of the action, decision, or project when added to the other past, present, and reasonably foreseeable future actions (RFFAs), regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

5.2 ASSUMPTIONS FOR ANALYSIS

Direct and indirect consequences of the Proposed Action were evaluated previously in Chapter 4. Analyzed in this chapter are those resources from Chapter 4 that have the potential to be incrementally impacted by the Proposed Action within the identified cumulative impacts assessment area (CIAA) described below and shown on Figure 11. Based on the preceding analysis in Chapter 4, no cumulative impacts are expected for the following resources: Native American religious concerns, paleontological resources, geology and minerals, rangeland management, recreation, land use authorizations, and wetlands and riparian zones.

Description of CIAA Boundaries

Based on the analysis of the potential impacts of the Proposed Action and the resources that would be impacted, the Interdisciplinary Team determined that the Hydrologic Unit Code (HUC) 5 watershed (Yellowstone Canyon) would suffice as the CIAA for all resources analyzed in this chapter. The Yellowstone Canyon HUC 5 watershed was identified as the CIAA for analysis of all resources because the Proposed Action is unlikely to have measureable incremental effects outside of this area. The CIAA is located within Pershing County and Humboldt County, Nevada, and includes approximately 168,000 acres (Figure 11) of public and private land combined (Figure 12). The eastern limit of the CIAA is defined by the ridgeline of the Tobin Range and the Sonoma Range. The western limit of the CIAA is defined by the ridgeline of the East Range. The southern limit of the CIAA is located approximately 7 miles south of the Lease Area, at the top of the Spring Creek drainage basin. The northern limit of the CIAA is located approximately 7 miles north, at the top of the Clear Creek drainage basin.

5.3 PAST AND PRESENT ACTIONS

Past and present actions in the CIAA include the following: aggregate operations, minerals exploration, mining, livestock grazing, rangeland management, wildland fires, ROWs, transportation networks, and dispersed recreation. The BLM Land and Mineral Legacy Rehost

2000 System (LR2000) (BLM 2011) and aerial photographs were used to identify and quantify past and present actions and RFFAs occurring within the CIAA.

Aggregate Operations
There are approximately 10 acres of disturbance associated with two mineral material sites in the CIAA.

Mineral Exploration and Mining
Kinross Gold USA, Big Mike Mining, Eco Vat Copper, Barrick Gold, and other operators have performed exploration and mining activities within the CIAA that resulted in surface disturbances and numerous roads. Prominent activities include mineral mining at the Goldbanks Site and the Big Mike Copper Mine. Aerial photographs indicate that approximately 155 acres were disturbed at the Goldbanks Site and approximately 130 acres were disturbed at the Big Mike Copper Mine. The Barrick Gold Rye Project (NVN-64582) is currently undergoing reclamation. Approximately 7 acres of disturbance at the project are awaiting final release from reclamation.

Rangeland Management and Livestock Grazing
There are portions of five grazing allotments within the CIAA. These allotments are administered by the BLM HRFO and include the Clear Creek, Dolly Hayden, Goldbanks, Klondike, and Pleasant Valley Allotments. Details for the Clear Creek Allotment, which is the allotment that the Lease Area is within, are included in Section 3.14. The Goldbanks Allotment Grazing Permit renewal was recently authorized by the BLM. The renewal includes creation of the Table Mountain pasture through conversion of a temporary fence into a permanent pasture fence within the allotment. The size of this allotment and others within the CIAA is listed in Table 12.

Table 12 Allotments Located Within the CIAA

Allotment Name	Size (acres)	Area Within CIAA (acres)
Clear Creek	67,610	48,025
Dolly Hayden	133,191	75,564
Goldbanks	40,961	39,520
Klondike	79,311	465
Pleasant Valley	185,289	3,822

Ranching
There are two developed ranch sites within the CIAA, the Hot Springs Ranch Site, and the Mud Springs Ranch Site. Based on aerial photography, the Hot Springs Ranch Site is approximately 180 acres in size and the Mud Springs Ranch Site is approximately 140 acres in size.

Wildland Fires
Wildland fires burned approximately 51,060 acres within the CIAA between 1999 and 2007 according to GIS data provided by the NDOW.

Rights-of-Ways (ROWs)
Ten ROW authorizations are located within the CIAA and include two associated with a mineral material site, three associated with power transmission lines, one associated with a gas pipeline, two associated with roads, and two associated with realty.

Transportation Networks
There are approximately 200 miles of unpaved roads within the CIAA, including approximately 18 miles of Grass Valley Road. Grass Valley Road is subject to regular maintenance. Assuming an average road width of 15 feet, approximately 364 acres of disturbance has occurred as a result of construction of 200 miles of road.

Recreation
Dispersed recreation occurs throughout the CIAA; however, there are no data on the level of use.

5.4 REASONABLY FORESEEABLE FUTURE ACTIONS

RFFAs are actions that are known or could reasonably be anticipated to occur within the CIAA within a time frame appropriate to the expected impacts to each resource resulting from the Proposed Action. These RFFAs include continuation of livestock grazing and rangeland management, ranching, aggregate operations, ROWs, use and maintenance of roads, and dispersed recreation. Other RFFAs within the CIAA include expansion of existing mineral material sites, and mineral exploration.

Expansion of Mineral Material Sites
There are two existing mineral material sites within the CIAA that are each approximately 5 acres in size. A 15-acre expansion is proposed at each of the sites.

Mineral Exploration
The BLM is currently preparing an EA for the Goldbanks Exploration Project (NVN-83627). Approximately 117 acres would be disturbed from this project.

Table 13 Past, Present, Proposed, and Foreseeable Future Surface Disturbance for the Proposed Action Cumulative Impact Assessment Area

Activity	Surface Disturbance (acres)
Past, Present, Proposed Disturbance ([1])	
Aggregate operations	10
Mineral exploration and mining	292
Geothermal exploration (Proposed Action)	70
Ranch sites	320
Livestock grazing	*
Wildland fires	51,060
ROWs	310
Transportation Networks	364
Recreation	0
Subtotal:	52,356
Reasonably Foreseeable Disturbance	
Aggregate operations	30
Mineral exploration	117
Ranch sites	0
Livestock grazing	*
Wildland fires	*
ROWs	0
Transportation Networks	0
Recreation	0
Subtotal:	147
Total Cumulative Surface Disturbance	**52,573**

*The quantity of the surface disturbance from these activities cannot be estimated.

[1] Disturbance is approximate and estimated.

5.5 CUMULATIVE IMPACTS TO AFFECTED RESOURCES

5.5.1 Air Quality

Past and Present Actions: Present actions within the CIAA that are likely to be contributing to air quality impacts include the area burned by wildland fire, dispersed recreation, aggregate operations, and transportation networks. These activities are principally contributing point source particulate matter emissions and fugitive dust to the air quality impacts; however, products of combustion are also emitted.

RFFAs: RFFAs within the CIAA that may contribute to impacts to air quality include continued dispersed recreation, use and maintenance of transportation networks, expansion of the two mineral material sites, and mineral exploration at the Goldbanks Exploration Project. Impacts to air quality would occur from the emissions of point source particulate matter, fugitive dust, and the products of combustion.

Cumulative Impacts from the Proposed Action: Cumulative impacts to air quality within the CIAA would result from the past and present actions and RFFAs when combined with the

Proposed Action. The incremental contribution of the Proposed Action's particulate and combustion emissions and fugitive dust would be relatively small, and the cumulative emissions are generally dispersed. Other RFFAs are not within a distance of the Project Area expected to compound emission levels. As a result, the Proposed Action would contribute minimally and incrementally to cumulative impacts on air quality.

Cumulative Impacts from the No Action Alternative: Cumulative impacts to air resources within the CIAA would result from the present and RFFAs when combined with this alternative. There are no emissions associated with this alternative, and therefore there would be no incremental contribution from this alternative.

5.5.2 Cultural Resources

Past and Present Actions: Past gravel extraction at the existing gravel pit has adversely impacted a NRHP site (Estes and Stoner 2011).

RFFAs: The continued use of the pit under the RFFA scenario would result in adverse impacts to the NRHP site because the site currently is not protected or mitigated.

Cumulative Impacts from the Proposed Action: The NRHP site would be incrementally destroyed from gravel extraction.

Cumulative Impacts from the No Action Alternative: If Ormat does not proceed with the proposed geothermal exploration project, then no mitigation measures would be in place to protect the site CrNV-02-0995. Under this scenario, further encroached to the cultural site would occur and with time, the cultural site would be destroyed.

5.5.3 Native American Religious Concerns

As defined by 40 CFR 1508.7, the cumulative impact is the impact which results from the incremental impact of the action, decision, or project when added to the other past, present, and reasonably foreseeable future actions. Based on the preceding analysis in Chapter 4, incremental impacts to Native American religion concerns and resources are not expected as a result of the Proposed Action. Consequently, no cumulative impacts are expected.

5.5.4 Invasive, Non-Native Species

Past and Present Actions: Past and present actions have resulted in the removal of established native vegetation and exposure of soils, conditions which are conducive to the spread and establishment of invasive and non-native species. Ranch sites have impacted approximately 320 acres, while construction of roads and mineral material sites has impacted 370 acres of vegetation and soils. Construction and utilization of roads and mineral material sites involve machinery and vehicles which may be a means of transport for noxious weed seeds. Past mining and mineral exploration activities impacted more than 292 acres and also include machinery and vehicles that potentially transport weeds. Wildland fires have impacted approximately 51,060 acres within the CIAA. When these burnt areas were undergoing natural revegetation, the

conditions caused by the fire left the areas susceptible to establishment of non-native, invasive species such as cheatgrass. Past spread of invasive non-native species is also associated with livestock grazing and diverse recreation.

RFFAs: Potential impacts from invasive, non-native species as a result of mineral exploration, livestock grazing, transportation networks, ROWs, dispersed recreation, any of which would be anticipated to result in removal of native vegetation and exposure of soils, and would result in increased potential for invasive, non-native species infestations. The loss of vegetation associated with wildland fires could occur as well and would be expected to result in continued potential of invasive, non-native species infestations. Other RFFAs that would potentially cause impacts from invasive, non-native species include the Goldbanks Exploration Project and expansion of the two mineral material sites in the CIAA. Approximately 117 acres of vegetation and soils would be impacted by the Goldbanks Exploration Project, and 30 acres would be impacted by expansion of the mineral material sites.

Cumulative Impacts from the Proposed Action: Cumulatively, the past, present, and RFFAs in combination with the Proposed Action would result in potential impacts from invasive, non-native species that would be limited to infestations following removal or disturbance of vegetation. Without weed abatement, weeds have the potential to spread and compete with native vegetation.

The Proposed Action (approximately 69.79 acres) would impact 0.04 percent of the CIAA (approximately 168,000 acres). The past and present actions and RFFAs would impact approximately 52,000 acres of the CIAA. The potential impacts from the Proposed Action would be minimized due to the implementation of environmental protection measures outlined in Section 2.2 including the following BMPs: concurrent reclamation efforts, operator control, and removal of invasive, non-native species and noxious weeds on reclaimed areas. As a result, the Proposed Action is not anticipated to contribute an incremental impact to invasive, non-native species in the CIAA.

Cumulative Impacts from the No Action Alternative: Cumulatively, the past, present, and RFFAs would result in potential impacts from invasive, non-native species that would be limited to infestations following removal of vegetation. Other than acres of wildfire, these impacts would be localized. The No Action Alternative would result in removal of approximately 147 acres of additional vegetation and disturbance of surface soils.

5.5.5 Wildlife, Including Migratory Birds and Special Status Species

Past and Present Actions: Wildlife species, including special status species and migratory birds, have been impacted by past and present actions within the CIAA. Ranch sites have converted approximately 320 acres of wildlife habitat to agricultural fields, pastures, and structures. Livestock grazing has contributed to the alteration of natural habitat through seasonal grazing within the CIAA. Wildland fires have burned and altered more than 51,600 acres of habitat

within the CIAA, which alone represents approximately 30 percent of the total area within the CIAA. This disturbance has reduced the extent of the sagebrush habitat in the higher elevations (hills and mountains) of the CIAA, reducing the habitat that could support mule deer, sage-grouse, and sagebrush-nesting migratory bird species. More than 285 acres of wildlife habitat have been impacted by mineral exploration and mining in the CIAA. Aggregate operations have impacted an additional 10 acres of wildlife habitat within the CIAA. The transportation network in the CIAA includes approximately 200 miles of unpaved roads that represent at least 360 acres of permanent impacts to wildlife habitat. Roads have inevitably resulted in injury and potentially death of migratory birds as a result of vehicle strikes. Overhead transmission lines within ROWs in the CIAA have provided some nesting and perching habitat for raptor species but simultaneously increased predation of small mammals, reptiles, and ground-nesting bird species. Construction of overhead transmissions lines and other ROWs have also resulted in removal or alteration of wildlife habitat.

RFFAs: The continued utilization and maintenance of transportation networks and ROWs would be anticipated to impact wildlife through continued fragmentation of habitat and injury or death from occasional vehicle strikes. The ROWs specific to overhead transmission lines would continue to provide nesting and perching habitat for raptors while increasing predation among smaller terrestrial wildlife species and ground-nesting bird species. Expansion of the existing mineral material sites within the CIAA would be anticipated to impact 30 acres of habitat. Mineral exploration and mining would also be expected to impact wildlife habitat. The MBTA would protect migratory birds and their nests from direct impacts, and migratory bird nesting surveys would be completed before RFFAs would be permitted to commence on public lands. The RFFAs on public land would require BLM authorization. BLM would require proper protection of special status species and the suitable habitat for those species when issuing such authorizations.

Cumulative Impacts from the Proposed Action: Cumulatively, the past, present, and RFFAs in combination with the Proposed Action would result in potential impacts to wildlife, including migratory birds and special status species. Wildland fires have burned and altered approximately 51,060 acres of wildlife habitat in the CIAA, and construction of roads and ranch sites have resulted in approximately 680 acres of impacts to habitat. Mineral exploration and mining have impacted more than 292 acres of habitat, and aggregate operations have impacted 10 acres. Impacts from RFFAs would include 117 acres of surface disturbance from the Goldbanks Exploration Project and 30 acres of disturbance associated with expansion of the mineral material sites. The Proposed Action would contribute up to approximately 69.79 acres of surface disturbance to the impacts resulting from past and present actions and RFFAs.

Noise associated with the operation of drill rigs and associated equipment, as well as the increased presence of humans and human activity within the Project Area, would result in potential displacement of wildlife within the Project Area and nearby vicinity. This would also be expected to occur at the reasonably foreseeable future Goldbanks Exploration Project, which includes drill crews and a drill rig or rigs. Displacement resulting from noise, human presence,

and general disturbances related to the project would be for the duration of construction and drilling. The lease stipulations and the environmental protection measures listed in Section 2.2 would minimize impacts to wildlife. As a result, the Proposed Action would have minimal and limited cumulative impacts to wildlife resources.

Cumulative Impacts from the No Action Alternative: The No Action Alternative would not result in exploration of potential geothermal resources within the Lease Area. There would be no alteration or removal of wildlife habitat and no impacts to wildlife. The No Action Alternative would not result in cumulative impacts to wildlife resources.

5.5.6 Wastes, Hazardous or Solid

Past and Present Actions: The primary past and present actions contributing to impacts resulting from spills or risk of spills of hazardous or solid wastes are mineral exploration and mining. Ranching and aggregate operations have contributed potential risks of spills due to use of petroleum products to power and lubricate farm machinery and excavation machinery. Ranching sites also have residential structures which contain sewage facilities. Limited quantities of hazardous and solid wastes may also be present when vehicles travel on roads within the CIAA, maintain roads and ROWs within the CIAA, or are used for recreation.

RFFAs: Potential impacts from solid and hazardous wastes as a result of continued ranching, aggregate operations, use of roads, maintenance of roads and ROWs, and dispersed recreation could occur. Such impacts would occur in the event of a spill or release of hazardous or solid material. Reasonably foreseeable mineral exploration would result in hazardous materials, particularly petroleum products, being stored or brought to locations within the CIAA. Potential impacts resulting from a spill of these materials could occur.

Cumulative Impacts from the Proposed Action: Solid waste and hazardous materials would be transported, stored, and used as part of the Proposed Action. Combined with the past, present, and RFFAs, the Proposed Action would result in potential impacts that would result from accidental releases or spills. However, all past, present, and reasonably foreseeable future actions are required to transport, store, and use solid waste and hazardous materials in accordance with applicable state and federal regulations which are intended to protect the public and the environment. Implementation of the measures described in Section 2.2 would minimize the potential for wastes and hazardous materials to be released to the environment from the Proposed Action in the event of a spill. As a result, the Proposed Action is not anticipated to contribute an incremental impact from spill or release of hazardous or solid wastes.

Cumulative Impacts from the No Action Alternative: The No Action Alternative would not result in the transport, storage, or use of hazardous or solid wastes by Ormat and therefore would not be anticipated to generate impacts.

5.5.7 Water Quality (Surface and Ground)

Past and Present Actions: Past actions that are likely to have impacts to surface water would have included mineral exploration, mining, livestock grazing, ranching, aggregate operations, ROWs, wildland fire, ROWs, transportation networks, and dispersed recreation. Construction of roads and ranch sites has impacted 680 acres of soils, thus increasing the possibility of sedimentation of nearby waters. Wildland fires burnt approximately 51,060 acres of vegetation cover, consequently exposing soils and increasing the potential for sedimentation. Since the fires occurred, the burnt areas have revegetated, which has resulted in stabilization of soils in these areas. Ranching and mineral exploration and mining have also likely had impacts to groundwater. Ranching includes groundwater and stock water wells, and mineral exploration has included drilling exploratory holes that may have reached the groundwater table.

RFFAs: Potential impacts to surface water could result from the continuation of livestock grazing, ROWs, aggregate operations, ranching, use and maintenance of roads, and dispersed recreation. The RFFAs potentially impacting surface water include a 15-acre expansion at each of the two mineral material sites and mineral exploration at the 117-acre Goldbanks Exploration Project. Mineral exploration would also be a source of potential impacts to groundwater. However, these RFFAs would be required to have spill prevention plans, handle hazardous substances in accordance with NDOT and NDEP, adhere to NAC 534.4369 and 534.4371 for borehole drilling and plugging, and utilize BMPs, thus minimizing impacts to water quality. BMPs would include the use of one or all of the following: sediment traps or sumps, straw bales (certified weed-free), silt fences, the distribution of clarified water from sediment traps through perforated pipes in order to minimize erosion from channeling, and the use of common, centrally located sediment sumps.

Cumulative Impacts from the Proposed Action: The Proposed Action (approximately 69.79 acres) would impact 0.04 percent of the CIAA (approximately 168,000 acres). Surface disturbance would increase the potential for erosion and sedimentation in drainages crossing the Project Area and the off-site surface water system. As a result, Ormat would implement the environmental protection measures listed in Section 2.2 to control erosion and prevent sedimentation from project disturbances. This would ensure that off-site surface waters are unaffected by the Proposed Action; therefore, the Proposed Action would not be anticipated to contribute to cumulative impacts on surface water quality.

The Proposed Action could potentially impact groundwater quality. Percolation of geothermal fluids from well testing and drilling could have a temporary impact on groundwater quality, but the impact would be localized and would be minimized through the implementation of the environmental protection measures described in Section 2.2. This potential impact would be temporary for the duration of drilling and well testing. Therefore the Proposed Action would be expected to have minimal cumulative impacts on groundwater quality.

Cumulative Impacts from the No Action Alternative: Cumulatively, the ongoing present actions and the RFFAs would result in impacts to surface water resources. These actions include

ongoing livestock grazing, ROWs, ranching, use and maintenance of roads, dispersed recreation, aggregate operations, future expansion of mineral material sites, and future mineral and geothermal exploration. Due to minimal ground disturbance associated with this alternative, this alternative would not contribute to impacts on surface or groundwater quality.

5.5.8 Paleontological Resources

As defined by 40 CFR 1508.7, the cumulative impact is the impact which results from the incremental impact of the action, decision, or project when added to the other past, present, and reasonably foreseeable future actions. Based on the preceding analysis in Chapter 4, incremental impacts to paleontological resources are not expected as a result of the Proposed Action. Consequently, no cumulative impacts are expected.

5.5.9 Geology and Minerals

As defined by 40 CFR 1508.7, the cumulative impact is the impact which results from the incremental impact of the action, decision, or project when added to the other past, present, and reasonably foreseeable future actions. Based on the preceding analysis in Chapter 4, incremental impacts to geology or mineral resources are not expected. Consequently, no cumulative impacts would be expected.

5.5.10 Soils

Past and Present Actions: Past actions that could have impacted soils would have included mineral exploration and mining, livestock grazing and ranching, aggregate operations, ROWs, construction of transportation networks, and dispersed recreation that disturbed or impacted soils or that increased erosion or sedimentation. Mineral exploration and mining have impacted more than 292 acres of soils and increased the potential for soil erosion in these disturbed areas. Ranching has impacted approximately 320 acres of soils. The transportation network includes 200 miles of unpaved roads. Construction of these roads impacted more than 360 acres of soils, and soil compaction has occurred on the travel surface the roads. Soil disturbance may also have been associated with wildland fires; however, some revegetation has occurred, stabilizing soil loss.

RFFAs: Potential impacts to soils in the reasonably foreseeable future include those from continued livestock grazing, ranching, maintenance of transportation networks, ROWs, and dispersed recreation or loss of vegetative cover associated with potential wildland fires. Other RFFAs that would be anticipated to impact soils include the Goldbanks Exploration Project and expansion of the existing mineral material sites. Approximately 117 acres of soils would be impacted by the Goldbanks Exploration Project, and expansion of the mineral material sites would impact about 30 acres of soil, increasing the potential for erosion and sedimentation.

Cumulative Impacts from the Proposed Action: The Proposed Action (approximately 69.79 acres) would impact 0.04 percent of the CIAA (approximately 168,000 acres). The potential impacts from the Proposed Action would be minimized due to the implementation of

environmental protection measures outlined in Section 2.2 and concurrent and final reclamation. As a result, a minimal incremental impact to soils in the CIAA is expected.

Cumulative Impacts from the No Action Alternative: The No Action Alternative would result in approximately 147 additional acres of surface disturbance resulting in minimal increased erosion.

5.5.11 Vegetation

Past and Present Actions: Past and present actions that have impacted vegetation within the CIAA include livestock grazing, ranching, wildland fires, mineral exploration and mining, aggregate operations, ROWs, and construction of transportation networks. Wildland fires have altered approximately 51,060 acres of vegetation within the CIAA, or roughly 30 percent of the total area within the CIAA. Construction of more than 200 miles of road has disturbed and permanently removed more than 360 acres of vegetation. Ranching has impacted approximately 320 acres, and past mining and exploration activities have disturbed more than 392 acres. Construction and operation of aggregate operations have impacted 10 acres of vegetation within the CIAA. Dispersed recreation has also likely impacted or reduced vegetation within the CIAA, primarily from overland travel.

RFFAs: Potential impacts from continued livestock grazing, ranching, and maintenance of ROWs are likely within the CIAA. The RFFAs likely resulting in impacts to vegetation include expansion of the existing mineral material sites within the CIAA and the future Goldbanks Exploration Project. Expansion of the mineral material sites would be anticipated to result in impacts to approximately 30 acres of vegetation. The BLM is currently preparing an EA for the Goldbanks Exploration Project in which 117 acres of disturbance is proposed. Future wildland fire may also impact vegetation within the CIAA.

Cumulative Impacts: Cumulatively, the past, present, and RFFAs in combination with the Proposed Action would result in potential impacts to vegetation. The Proposed Action (approximately 69.79 acres) would impact 0.04 percent of the CIAA (approximately 168,000 acres). The potential impacts to vegetation from the Proposed Action would be minimized due to concurrent reclamation and ultimately reclamation of all project disturbances. As a result, a minimal incremental impact to vegetation in the CIAA is expected from the Proposed Action. Figure 13 shows the SWReGAP (2004) vegetation cover classifications for areas within the CIAA.

Cumulative Impacts from the No Action Alternative: The disturbance of vegetation would not result from implementation of the No Action Alternative. Therefore this alternative would not result in cumulative impacts to vegetation.

5.5.12 Rangeland Management

As defined by 40 CFR 1508.7, the cumulative impact is the impact which results from the incremental impact of the action, decision, or project when added to the other past, present, and reasonably foreseeable future actions. Based on the preceding analysis in Chapter 4, incremental

impacts to livestock grazing and rangeland management are not expected as a result of the Proposed Action. Consequently, no cumulative impacts are possible.

5.5.13 Recreation

As defined by 40 CFR 1508.7, the cumulative impact is the impact which results from the incremental impact of the action, decision, or project when added to the other past, present, and reasonably foreseeable future actions. Based on the preceding analysis in Chapter 4, incremental impacts to recreation are not expected as a result of the Proposed Action. Consequently, no cumulative impacts are expected.

5.5.14 Visual Resources

Past and Present Actions: Past and present actions that have impacted visual resources within the CIAA include livestock grazing, ranching, wildland fires, mineral exploration and mining, aggregate operations, ROWs, and transportation networks. Most of the actions' impacts to visual resources are in the form of reduced or altered vegetation and landforms. Several structures and associated lighting are located within the CIAA in connection with ranching. Livestock grazing, ROWs, and transportation networks have added linear features to the landscape in the form of fences, overhead transmission lines, and unpaved roads.

RFFAs: Impacts to visual resources resulting from continued livestock grazing, ranching, aggregate operations, ROWs, and use and maintenance of transportation networks are anticipated in the reasonably foreseeable future. Impacts to visual resources from past mining operations would be present through the reasonably foreseeable future, and future mineral exploration associated with the 117-acre Goldbanks Exploration Project would result in impacts to visual resources, largely from removal of vegetation and presence of exploratory drilling equipment. Expansion of the existing mineral material sites within the CIAA would also be anticipated to impact visual resources by removing approximately 30 acres of vegetation cover and excavating into the ground surface.

Cumulative Impacts: Cumulatively, the past, present, and RFFAs in combination with the Proposed Action would result in potential impacts to visual resources within the CIAA. The Proposed Action would result in removal of vegetation during construction of well pads and roads and expansion of the mineral material site. Stockpiling of soil and construction of reserve sumps would create alterations in the natural landforms. Drill rigs, drill crew living quarters, lighting, and other equipment would be visible from Grass Valley Road. The project's impacts to visual resources would be in combination with the impacts from past and present actions and RFFAs in the CIAA. Wildland fire has impacted approximately 51,060 acres of vegetation in the CIAA, and construction of roads and ranch sites has impacted 680 more acres of vegetation. Past mining has contributed more than 292 acres of surface disturbance, including direct removal of vegetation and alteration of the natural landform and shapes found in the landscape.

Visual impacts associated with the project would be limited to the period of active construction and drilling through final reclamation. Concurrent reclamation where possible in the Project

Area would reduce the intensity of the impact during this period. Because disturbed surfaces would be reclaimed and project equipment and personnel would be removed from the site following completion of the project, the Proposed Action would contribute only minimal impacts to visual resources.

Cumulative Impacts from the No Action Alternative: The No Action Alternative would not result in exploration of potential geothermal resources within the Lease Area. However there would be approximately 147 acres of additional cumulative disturbance associated with the RFFA to the existing visual landscape as a result of this alternative.

5.5.15 Land Use Authorizations

As defined by 40 CFR 1508.7, the cumulative impact is the impact which results from the incremental impact of the action, decision, or project when added to the other past, present, and reasonably foreseeable future actions. Based on the preceding analysis in Chapter 4, incremental impacts to land use authorizations are not expected as a result of the Proposed Action. Consequently, no cumulative impacts are expected.

5.5.16 Wetlands and Riparian Zones

As defined by 40 CFR 1508.7, the cumulative impact is the impact which results from the incremental impact of the action, decision, or project when added to the other past, present, and reasonably foreseeable future actions. Based on the preceding analysis in Chapter 4, incremental impacts to wetlands and riparian zones are not expected as a result of the Proposed Action. Consequently, no cumulative impacts are expected.

5.5.17 Noise

As defined by 40 CFR 1508.7, the cumulative impact is the impact which results from the incremental impact of the action, decision, or project when added to the other past, present, and reasonably foreseeable future actions. Based on the preceding analysis in Chapter 4, incremental impacts resulting from noise are not expected as a result of the Proposed Action. Consequently, no cumulative impacts are expected.

5.6 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

No irreversible and irretrievable commitment of resources is expected as a result of the Proposed Action.

CHAPTER 6
MITIGATION AND MONITORING

6.1 MITIGATION AND MONITORING

6.1.1 BLM Mitigation Measures

In addition to the lease stipulations and environmental protection measures, the following mitigation and monitoring measures were developed through the analysis as documented in this EA. The authorized officer would decide which measures go forward as Conditions of Approval. These would be made part of the decision record and the GDP approvals:

Cultural Resources

- Due to Native American religious beliefs concerning springs, it is important that the mitigation recommended in the Water Quality section be implemented.
- If gravel is to be taken from the existing mineral material pit, a boundary fence would be constructed to protect the existing prehistoric site. The boundary fence would be built to the width of the proposed gravel pit and include appropriate signage.

Native American Religious Concerns

- Project-related traffic should be restricted to access roads and well pads.
- Native Americans should be allowed access to TCPs and sacred sites, if discovered.
- Due to Native American religious beliefs concerning springs, it is important that the mitigation recommended in the Water Quality section be implemented.

Water Quality

Leach Hot Springs are located on private property immediately downstream and adjacent to the Lease Area. Due to their proximity, they appear to be potentially connected to the proposed action with the potential that development of the geothermal reservoir could impact them. Adverse impacts to surface expressions of the geothermal reservoir (hot springs) are not acceptable. With the permission of the water rights owner, the lessee will monitor the quality, quantity, and temperature of Leach Hot Springs as follows:

- Prior to commencement of exploration activities, the operator should institute a BLM approved water monitoring program.

Vegetation

- Sagebrush seedlings would be required in disturbed sagebrush habitat. Density of seedlings should be 0.25 per meter square (1 seedling per 4 meters), or 1,000 seedlings per acre. Seedlings would be planted between February 15 and April 1.

Wildlife

- To mitigate for the potential impacts to mule deer use, operations within the areas mapped as crucial winter habitat for mule deer would not be permitted between December 15 and March 15. Should sufficient additional data be collected to determine actual mule deer use within the Project Area, modifications to these dates could be made by the BLM in consultation with the NDOW. The seasonal restriction for crucial mule deer winter habitat also applies to wintering sage-grouse.
- Sagebrush seedlings would be required in disturbed sagebrush habitat. Density of seedlings should be 0.25 per meter square (1 seedling per 4 meters), or 1,000 seedlings per acre. Seedlings would be planted between February 15 and April 1.

Special Status Species

- Should construction or drilling occur within a one-half mile distance of an active raptor nest, including the known ferruginous hawk nest in the Project Area, construction shall be delayed until any young birds have fledged from the nest. Should raptors begin to nest in the Project Area after the initiation of drilling, the birds would be considered habituated to the disturbance and drilling could continue.
- Sagebrush seedlings would be required in disturbed sagebrush habitat. Density of seedlings should be 0.25 per meter square (1 seedling per 4 meters), or 1,000 seedlings per acre. Seedlings would be planted between February 15 and April 1.

6.1.2 Environmental Protection Measures

Environmental protection measures introduced in Chapter 2 are reiterated here. This section includes the environmental protection measures that Ormat would implement during construction and operation of the Proposed Action. For purposes of this EA, environmental protection measures include standard operating procedures.

Prevention and Control of Fires

Ormat would implement the following fire contingency plan in the event any fire started on or near the Project Area:

- Any small fires which occur around the well pad during drilling and/or testing operations should be able to be controlled by rig personnel utilizing on-site firefighting equipment.
- The BLM Winnemucca District Office (775.623.3444 or 800.535.6076) would be notified immediately of any wildland fire, even if the available personnel can handle the situation or the fire poses no threat to the surrounding area.
- A roster of emergency phone numbers would be available at the project site so that the appropriate firefighting agency can be contacted in case of a fire.
- All vehicles would carry, at a minimum, a shovel, 5 gallons of water (preferably in a backpack pump), and a conventional fire extinguisher.
- Adequate fire-fighting equipment (a shovel, a Pulaski, standard fire extinguisher(s), and an ample water supply) would be kept readily available at each active drill site. Water that is used for construction and dust control would be available for fire suppression.

- Vehicle catalytic converters (on vehicles that enter and leave the drill site on a regular basis) would be inspected often and cleaned of all flammable debris.
- All cutting/welding torch use, electric-arc welding, and grinding operations would be conducted in an area free, or mostly free, from vegetation. An ample water supply and shovel would be on hand to extinguish any fires created from sparks. At least one person in addition to the cutter/welder/grinder shall be at the work site to promptly detect fires created by sparks.
- Personnel would be responsible for being aware of and complying with the requirements of any fire restrictions or closures issued by the BLM Winnemucca District Office, as publicized in the local media or posted at various sites throughout the field office district.
- Personnel shall be allowed to smoke only in designated areas and would be required to follow applicable BLM regulations regarding smoking.

Soils

The Project Area is relatively flat, with gentle slopes of less than 5 percent. Based on the low average annual precipitation of less than 9 inches per year (WRCC 2009) and relatively flat terrain within the Project Area, the potential for soil erosion should be minimal. Ormat would implement the following protection measures to minimize watershed and other resource damage:

- Topsoil would be salvaged, stockpiled, and reused in a timely manner.
- All disturbed surfaces that are currently vegetated, including those that are disturbed temporarily during construction only, would be reseeded using the BLM-provided seed mix presented in Table 5.
- Erosion control measures, including but not limited to silt fencing, diversion ditches, water bars, temporary mulching and seeding, and application of gravel or riprap, would be installed, where necessary, immediately after completion of construction activities to avoid erosion and runoff.
- Access roads would follow existing contours to the maximum extent possible. In areas where new access roads must be constructed across slopes, erosion control measures such as silt fence, surface roughening of slopes, and slope stabilization would be provided as necessary.
- An average of 6 inches of gravel would be used as road surface where appropriate because roads would be used during all seasons. Gravel applied to road surfaces and drill pads would be removed during reclamation as described in Section 2.1.8.2.
- Gravel would be laid down when ground conditions are wet enough to cause rutting or other noticeable surface deformation or severe compaction. As a general rule, if vehicles or other project equipment create ruts in excess of 4 inches deep when traveling cross-country over wet soils, a gravel surface would be added prior to additional vehicle use.
- In areas of very soft soils, up to 3 feet of aggregate would be used during construction.

Water Quality - Surface and Ground

In order to further prevent and minimize potential impacts to water quality, Ormat would implement the environmental protection measures listed below.

Surface Water

Several topographical drainages representing ephemeral, intermittent, or seasonal drainages exist in the proposed Project Area. No springs or wetlands are present within the Lease Area; however, Leach Hot Springs is located on private land immediately down-gradient and adjacent to the Lease Area. It is possible that impacts to surface drainages and Leach Hot Springs could occur during significant storm events. Potential releases of materials used during construction activities, primarily hydrocarbon releases from construction equipment, could potentially impact storm water. Prior to construction, Ormat would develop a spill and discharge contingency plan that details specific containment, cleanup and abatement, and notification procedures that would be implemented in the event of a spill or discharge. Ormat would implement BMPs during construction to prevent the contamination of storm water runoff.

The BMPs would include the following:

- When proposed new access roads must cross ephemeral washes, rolling dips would be installed. The rolling dips would be designed to accommodate flows from at least a 25-year storm event. Culverts could potentially be used wherever rolling dips are not feasible.
- Silt fences and/or straw bales would be used in areas requiring sediment control.
- Roads and well pads not required for further geothermal development purposes would be re-contoured to preconstruction conditions and seeded to prevent erosion.
- Access roads would follow existing contours to the maximum extent possible. In areas where new access roads must be constructed across slopes, erosion control measures such as silt fencing, surface roughening of slopes, and slope stabilization would be provided as necessary.
- Erosion control measures, including but not limited to silt fencing, diversion ditches, water bars, temporary mulching and seeding, and application of gravel or riprap, would be installed, where necessary, immediately after completion of construction activities to avoid erosion and runoff.

Groundwater

Ormat would implement various environmental protection measures to ensure that groundwater quality is not impacted from exploration drilling activities. The protection measures would include the following:

- Excavation into native soil during construction of well pad reserve pits would be minimized to the maximum extent possible.
- Drill pad reserve pits would be compacted during construction, and settled bentonite clay from drilling mud would accumulate on the bottom of the drill pad reserve pits to act as an unconsolidated clay liner, reducing the potential for drilling fluid to percolate to groundwater.
- A BLM-approved cementing and casing program for the drilling of exploration wells would be implemented to prevent water quality effects on groundwater during or after completion of the wells.

- Borehole geophysics analyses (cement bond logs) would be conducted to document that well casing cementing activities provide an effective seal isolating the geothermal aquifer from shallow alluvial aquifers, therefore minimizing potential impacts to the shallow aquifers, connected surface springs, or streams.
- The project would use BMPs to ensure that any geothermal fluid encountered during the drilling does not flow uncontrolled to the surface. These include the use of "blow-out" prevention equipment during drilling and the installation of well casing cemented into the ground.
- Any well on the leased land that is not in use or demonstrated to be potentially useful would, upon approval by the BLM, be promptly plugged and abandoned in accordance with lease stipulations. No well would be abandoned until it has been demonstrated to the satisfaction of the BLM that it is no longer capable of producing in commercial quantities and would not serve any other useful purpose for this project such as for injection of geothermal fluids or monitoring of the geothermal reservoir or groundwater. All wells would be plugged on the completion of the project.

Biological Resources, Fish and Wildlife

The following environmental protection measures would be implemented to minimize impacts to biological resources:

- Trash and other waste products would be properly managed, and Ormat would control garbage that could attract wildlife. All trash would be removed from the Project Area and disposed of at an authorized landfill.
- A speed limit of 25 miles per hour would be observed on roads within the Project Area, and if necessary, would be reduced when wildlife is active near access and service roads. The 25–mile-per-hour speed limit would be posted at the project site.
- Employees and contractors would be strictly prohibited from carrying firearms (or similar hunting-type weapons) on the job site to discourage illegal hunting and harassment of wildlife.
- Reclamation of the disturbed areas, as described earlier in this document, would be completed in order to return these areas to the condition required in the drilling permit Conditions of Approval.
- The well pads would be constructed to avoid ephemeral washes to the extent practicable. The pads would be designed to divert sheet wash or water in drainages around and away from drill pads.
- Sagebrush seedlings would be planted during interim and final reclamation in topographic drainages and draws (areas of concentrated sagebrush) where project disturbance is created.
- Reserve pits would be constructed and fenced in accordance with the BMPs identified in the Gold Book (BLM 2007).

Vegetation

- Impacts to vegetation would be minimized by reseeding all areas of access roads and well pads not required for subsequent energy production using weed free and BLM-approved

seed mixtures (Table 5). Seeding would be conducted between October 1 and December 31. Disturbed areas would be re-contoured to blend with the surrounding topography. Topsoil would be salvaged whenever possible and reused in a timely manner.

- The well pads would be constructed to avoid ephemeral washes to the extent practicable. The pads would be designed to divert sheet wash or water in drainages around and away from drill pads.
- Sagebrush seedlings would be planted during interim and final reclamation in topographic drainages and draws (typically areas of concentrated sagebrush) where project disturbance is created.

Air Quality

In order to ensure impacts to air quality resulting from implementation of the Proposed Action are minimized, Ormat would put the following environmental protection measures into practice during construction and operation of the project:

- All applicable state and federal air quality standards would be met through the use of the best available technology to control emissions.
- Equipment and vehicle idling times would be minimized during construction and operation.
- A maximum speed limit of 25 miles per hour would be enforced on unpaved roads within the Project Area in order to reduce fugitive dust emissions.
- Access roads, Project Area roads, and other traffic areas would be maintained on a regular basis to minimize dust and provide safe travel conditions.
- Proposed access roads would be surfaced with aggregate where appropriate.
- Dust abatement techniques, such as watering, would be used on unpaved roads and in areas where soils are exposed in order to reduce fugitive dust emissions.
- Dust abatement techniques, such as watering, requiring loader buckets to be emptied slowly, and minimizing drop heights, would be applied during earthmoving, excavating, trenching, grading, and aggregate crushing and processing activities.
- H_2S levels would be monitored during drilling of temperature gradient, observation, and production wells.

Noise

In order to protect the drilling crew and personnel from exposure to loud noise and reduce the total noise emissions of the project, Ormat would implement the following environmental protection measures:

- Noise suppression devices would be utilized on all compressors.
- Ear protection would be required for all personnel.

Land Use Authorizations

Ormat would comply with the lease stipulations provided below and implement the listed environmental protection measures to ensure that impacts to land use authorizations are avoided:

- Ormat would contact all parties that currently hold ROWs in the vicinity of the Project Area, including NV Energy, regarding overhead transmissions that cross the northern areas of the Project Area.
- Ormat would not perform any drilling activities within existing ROWs.
- Ormat would contact ROW holders for locations of underground utilities prior to commencement of the project.

Visual Resources

To minimize temporary and permanent visual resource impacts from construction of access roads and well pads and drilling of wells, Ormat would take the following actions:

- Standard dust control mitigation methods would be used during construction and grading.
- Cut and fill areas would be minimized by proper placement of roads and well pads.
- Features placed at the well pads would be removed after drilling and testing so that only the wellhead extends above the well pad. Wellheads would be painted a color that blends with the surrounding area, as approved by the BLM.
- Drill rig and well test facility lights would be limited to those required to safely conduct the operations.
- To avoid light pollution onto adjacent areas as viewed from a distance, Ormat would utilize directional lighting directed downward onto the pertinent site only and away from adjacent areas. Ormat would utilize lighting that is hooded and shielded so as not to allow the bulb to shine up or out for all lighting associated with the project with the exception of vehicle headlamps.

Paleontological Resources

- In the event that previously undiscovered paleontological resources are discovered in the performance of any surface-disturbing activities, the item(s) or condition(s) would be left intact and immediately brought to the attention of the authorized officer of the BLM.

Cultural, Archaeological, and Native American Resources

- Ormat would avoid known eligible and potentially eligible cultural resource sites through design, construction, and operation of the project.
- An approximately 100-foot buffer zone would be established around eligible and potentially eligible cultural resource sites to help provide protection to the sites. Project facilities and disturbance would not encroach into the established 100-foot buffer zone.
- The project facilities would be operated in a manner consistent with the engineered design to prevent problems associated with the runoff that could affect adjacent cultural sites. This includes the use of BMPs to minimize off-site erosion and sedimentation.
- Ormat would limit vehicle and equipment travel to existing and proposed roads, well pad locations, and construction areas. Ormat would limit travel to existing roads in order to access the proposed mineral material site expansion area.
- Any unplanned discovery of cultural resources, items of cultural patrimony, sacred objects, human remains, or funerary items requires that all activity in the vicinity of the

find ceases and the District Manager, Humboldt River Field Office, 5100 East Winnemucca Boulevard, Winnemucca, Nevada 89445, be notified immediately by telephone (775.623.1500) with written confirmation to follow. The location of the find would not be publicly disclosed, and any human remains must be secured and preserved in place until a Notice to Proceed is issued by the authorized officer.

Noxious Weeds and Invasive, Non-native Species (Vegetation)

Ormat would implement the following environmental protection measures to control spread or establishment of noxious weeds and invasive species within the Project Area:

- Ormat would map and treat areas that become infested with invasive species/noxious weeds during construction, and use certified weed-free seed and mulching materials in accordance with lease stipulations.
- Any new noxious weed infestations would be treated.
- Ormat would provide the BLM, Winnemucca District Weed Specialist with copies of pre-construction Geographic Information System (GIS) coverages and maps, along with related reports that depict, on all areas of exploration, the presence or absence and identity of any noxious weeds or invasive, non-native species. Ormat would also provide the BLM with copies of any similar information generated from the applicant's noxious weed control program over the term of the project.

Wastes, Hazardous and Solid

Ormat would implement the environmental protection measures listed below to ensure that solid and hazardous wastes, if any, are managed in accordance with all applicable regulations.

- A project hazardous material spill and disposal contingency plan would describe the methods for cleanup and abatement of any petroleum hydrocarbon or other hazardous material spill. The hazardous material spill and disposal contingency plan would be submitted to and approved by the BLM and made readily available onsite before operations begin in accordance with lease stipulations.
- Secondary containment structures would be provided for all chemical and petroleum/oil storage areas during drilling operations. Additionally, absorbent pads or sheets would be placed under likely spill sources and spill kits would be maintained on-site during construction and drilling activities to provide prompt response to accidental leaks or spills of chemicals and petroleum products.
- Handling, storage, and disposal of hazardous materials, hazardous wastes, and solid wastes would be conducted in conformance with federal and state regulations to prevent soil, groundwater, or surface water contamination and associated adverse effects on the environment or worker health and safety.
- Portable chemical sanitary facilities would be available and used by all personnel during periods of well drilling and/or flow testing. These facilities would be maintained by a local contractor. All septic holding tanks would be located above ground.

CHAPTER 7
CONSULTATION AND COORDINATION

7.1 CONSULTATION AGENCIES, GROUPS, AND INDIVIDUALS CONSULTED

Nevada Natural Heritage Program
Eric S. Miskow

U.S. Fish and Wildlife Service
Robert Williams

Nevada Department of Wildlife, Cooperating Agency
Kenny Pirkle
Mark Freese
Timothy Herrick
Kyle Neill

University of Nevada Cooperative Extension, Cooperating Agency
Brad Schultz

Ormat Technologies, Inc.

Randy Peterson	Ormat Technologies, Inc.
Kyle Snyder	Ormat Technologies, Inc.
Scott Kessler	Ormat Technologies, Inc.

Native American Consultation

BLM HRFO initiated Native American consultation with the Lovelock Paiute Colony, the Fallon Paiute Shoshone Tribe, the Winnemucca Indian Colony, and the Battle Mountain Band Council with letters sent to the tribes on April 22, 2010. The letters provided a brief overview of the project and asked that the tribes initiate consultation or provide any comments or other expressions of interest in the project by May 28, 2010. Telephone messages from the BLM to the Winnemucca Colony were left on May 11, 18, and June 2, 2010. Telephone messages were left with the Battle Mountain Band on May 24, June 2, and June 8, 2010. The Fallon Paiute Shoshone tribe had no comment on the project in either the May or June 2010 consultation meetings. The Preliminary EA was sent out during the first week of March 2011 to the above listed tribes and the Shoshone-Paiutes of Duck Valley, and no comments were received during the 30-day public review period.

The following tribal representatives were contacted:

Michael Price	Battle Mountain Band Council, Te-Moak Tribe of Western Shoshone Indians
Linda Ayer	Winnemucca Indian Colony
Victor Mann	Lovelock Paiute Tribe
Alvin Moyle	Fallon Paiute Shoshone Tribe

CHAPTER 8
LIST OF PREPARERS

8.1 PREPARERS

Table 14 List of Preparers

Name	Title	Project Expertise
Bureau of Land Management		
Marcie Purkey	HRFO Geothermal Project Lead	Geology/Fluid Minerals
Fred Holzel	HRFO Fluid Minerals Program Lead	Geology/Minerals
Lynn Ricci	Planning and Environmental Coordinator	NEPA Compliance
Mike Zielinski	Soil Scientist, Air Quality & Riparian Zone Specialist	Riparian Zones, Soils, and Vegetation
Jeanette Black	Hydrology Specialist	Hydrology
Robert Burton	Natural Resource Specialist	Invasive and Non-Native Species
Amanda DeForest	Supervisory Natural Resource Specialist	Wildlife, Threatened and Endangered Species, and Special Status Species
Nancy Spencer-Morris	Threatened and Endangered Species and Wildlife Biologist	Wildlife
Patrick Haynal, Ph.D.	Archaeologist	Cultural Resources and Paleontology
Mark Hall, Ph.D.	Cultural Specialist and Native American Coordinator	Cultural Resources and Native American Religious Concerns
Joey Carmosino	Outdoor Recreation Planner	Recreation and Visual Resource Management
Ron Pearson	Rangeland Management Specialist	Rangeland Management
Sarah McGuire	Minerals Data Management and GIS Specialist	LR2000
Debbie Dunham	Lands and Realty Specialist	Lands and Realty
Jeff Johnson	Supervisory Fire Management Specialist	Fuels, Fire Management, and Fire Rehab
David Vincelette	Environmental Protection Specialist	Hazardous Materials, Environmental Permitting, and Regulatory Compliance
Robert Bunkall	GIS Specialist	GIS
Daniel Atkinson	Geologist	Mineral Material

Cooperating Agencies		
Mark Freese, NDOW		
Brad Schultz, UNCE		
JBR Environmental Consultants, Inc.		
Catherine Clark	Division Manager	Project Management, NEPA Compliance, and Quality Control
Matt Setty	Project Manager	Hydrology and Water Quality
Dave Worley	Senior Biologist	Wildlife, Migratory Birds, and Special Status Species
Doug Koza	Senior Scientist	NEPA Compliance, Geology, and Fluid Minerals
George Dix	Environmental Analyst	NEPA Compliance and Project Planning
Arnold Tiehm	Senior Botanist	Vegetation and Special Status Species
Christine Johnson	GIS Specialist	GIS Mapping
Alissa Dickerson	Air Quality Specialist	Air Quality
Tammy Odegard	Administrative Assistant	Document Support
Ed Stoner	Archaeologist (Western Cultural Resource Management, Inc.)	Cultural Resources/Cultural Survey

CHAPTER 9
REFERENCES

9.1 REFERENCES

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FIGURES

APPENDIX A

BLM – Federal Geothermal Leases

APPENDIX B

Noxious Weed Management Plan

APPENDIX C

Agency Correspondence

APPENDIX D

Special Status Species Summary Tables