BLM

ENVIRONMENTAL ASSESSMENT

ORNI 32, LLC
Dixie Meadows
Geothermal Utilization Project

DOI-BLM-NV-C010-2016-0014-EA

US Department of the Interior
Bureau of Land Management
Carson City District
Stillwater Field Office
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Carson City, NV 89701
775-885-6000

Partner Agencies:
Nevada Department of Wildlife
US Fish and Wildlife Service
Department of the Navy, Naval Air Station Fallon
US Geological Survey

August 2021

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

DOI-BLM-NV-C010-2016-0014-EA

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ACRONYMS AND ABBREVIATIONS

ACRONYMS AND ABBREVIATIONS	Full Phrase
2015 Decision	*Record of Decision and Approved Resource Management Plan Amendments for the Great Basin Region*
AAC	Abercrombie's Archaeological Consultants
ACHP	advisory council on historic preservation
ACSR	aluminum conductor steel-reinforced
amsl	above mean sea level
AOI	area of interest
APE	area of potential effect
APLIC	Avian Power Line Interaction Committee
ARMMP	aquatic resources monitoring and mitigation plan
ARPA	Archaeological Resources Protection Act
BAPC	Nevada Division of Environmental Protection Bureau of Air Pollution Control
BBCS	bird and bat conservation strategy
Bd	*Batrachochytrium dendrobatidis*
BGEPA	Bald and Gold Eagle Protection Act
BLM	United States Department of the Interior, Bureau of Land Management
BMP	best management practice
CCD	BLM Carson City District Office
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CRMP	*Carson City Field Office Consolidated Resource Management Plan*
DOI	United States Department of the Interior
EA	environmental assessment
EC	electrical conductivity
EGS	Engineered Geothermal Systems
EPM	environmental protection measure
ESA	Endangered Species Act of 1973
°F	degrees Fahrenheit
FEMA	Federal Emergency Management Agency
FLPMA	Federal Land Policy and Management Act of 1976
FONSI	finding of no significant impact
FPST	Fallon Paiute-Shoshone Tribe
GBBO	Great Basin Bird Observatory
gen-tie	generation-tie
Geothermal Sump Guidelines	*Design Features and Tools to Reduce Wildlife Mortalities Associated with Geothermal Sumps*
Gold Book	*Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, Fourth Edition*

gpm	gallons per minute
HQT	Nevada Greater Sage-Grouse Habitat Quantification Tool
IBA	important bird area
KOP	key observation point
kV	kilovolt
MBTA	Migratory Bird Treaty Act
mg/L	milligrams per liter
MOA	memorandum of agreement
MOU	memorandum of understanding
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NAS Fallon	Naval Air Station Fallon
Navy	United States Department of the Navy
NDEP	Nevada Division of Environmental Protection
NDOM	Nevada Division of Minerals
NDOW	Nevada Department of Wildlife
NDWR	Nevada Division of Water Resources
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act of 1966, as amended
NNHP	Nevada Natural Heritage Program
NOI	Notice of Intent
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSO	No Surface Occupancy
NV	Nevada
OHMA	other habitat management area
OHV	off-highway vehicles
Ormat	Ormat Nevada Inc.
ORNI 32	ORNI 32, LLC (a subsidiary of Ormat)
PEIS	programmatic environmental impact statement
PFYC	potential fossil yield classification
Protocol	State Protocol Agreement between the Bureau of Land Management, Nevada and the Nevada State Historic Preservation Office
RDF	required design feature
RMP	resource management plan
ROD	Record of Decision
ROW	right-of-way
SETT	Nevada Sagebrush Ecosystem Technical Team

SWPPP	stormwater pollution prevention plan
SWReGAP	Southwest Regional Gap Analysis Project
TCP	traditional cultural properties
TDS	total dissolved solids
UIC	underground injection control
US	United States
USACE	United States Army Corps of Engineers
USC	United States Code
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
VOC	volatile organic compounds
VRM	visual resource management
WSA	Wilderness Study Area

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Chapter 1.
Introduction/Purpose and Need

The United States (US) Department of the Interior (DOI), Bureau of Land Management (BLM) Carson City District (CCD), Stillwater Field Office has prepared this environmental assessment (EA) to analyze potential impacts on the human and natural environment that may result from the proposed plan for exploration, development, and utilization of geothermal resources (wells, pipelines, roads, and transmission lines that will supply two offsite 30-megawatt [MW] power-generating facilities proposed to be constructed on adjacent private lands) within the Ormat Nevada Inc. (Ormat) Combined Dixie Meadows Geothermal Unit Area (NVN-89456X), and from the construction and operation of an associated transmission line, or electrical generation-tie line (gen-tie), to bring electricity to market.

1.1 INTRODUCTION

ORNI 32, LLC (ORNI 32), a subsidiary of Ormat, is proposing the Dixie Meadows Geothermal Utilization Project (project) in Dixie Valley, approximately 43 miles northeast of Fallon in Churchill County, Nevada (see **Figure 1**, Project Location). An area of interest (AOI; see **Section 2.1**) has been established for the project. The AOI includes lands within the Dixie Meadows Geothermal Unit that have been shown to have the highest potential for commercial feasibility through previously conducted exploration activities.

ORNI 32 proposes to construct up to two 30 MW geothermal power plants; construct up to 18 well pads, upon which up to three wells per pad may be drilled for exploration, production, or injection; construct and operate pipelines to carry geothermal fluid between well fields and the power plant(s); and construct either a 120 kilovolt (kV) or a 230 kV transmission gen-tie and associated access roads and structures. The gen-tie would be constructed along one of two routes: one extending to the northeast to Jersey Valley, or one extending to the south to the NV Energy power line near US Highway 50. ORNI 32 has not yet finalized gen-tie interconnection agreements; both alternative routes are analyzed in this EA.

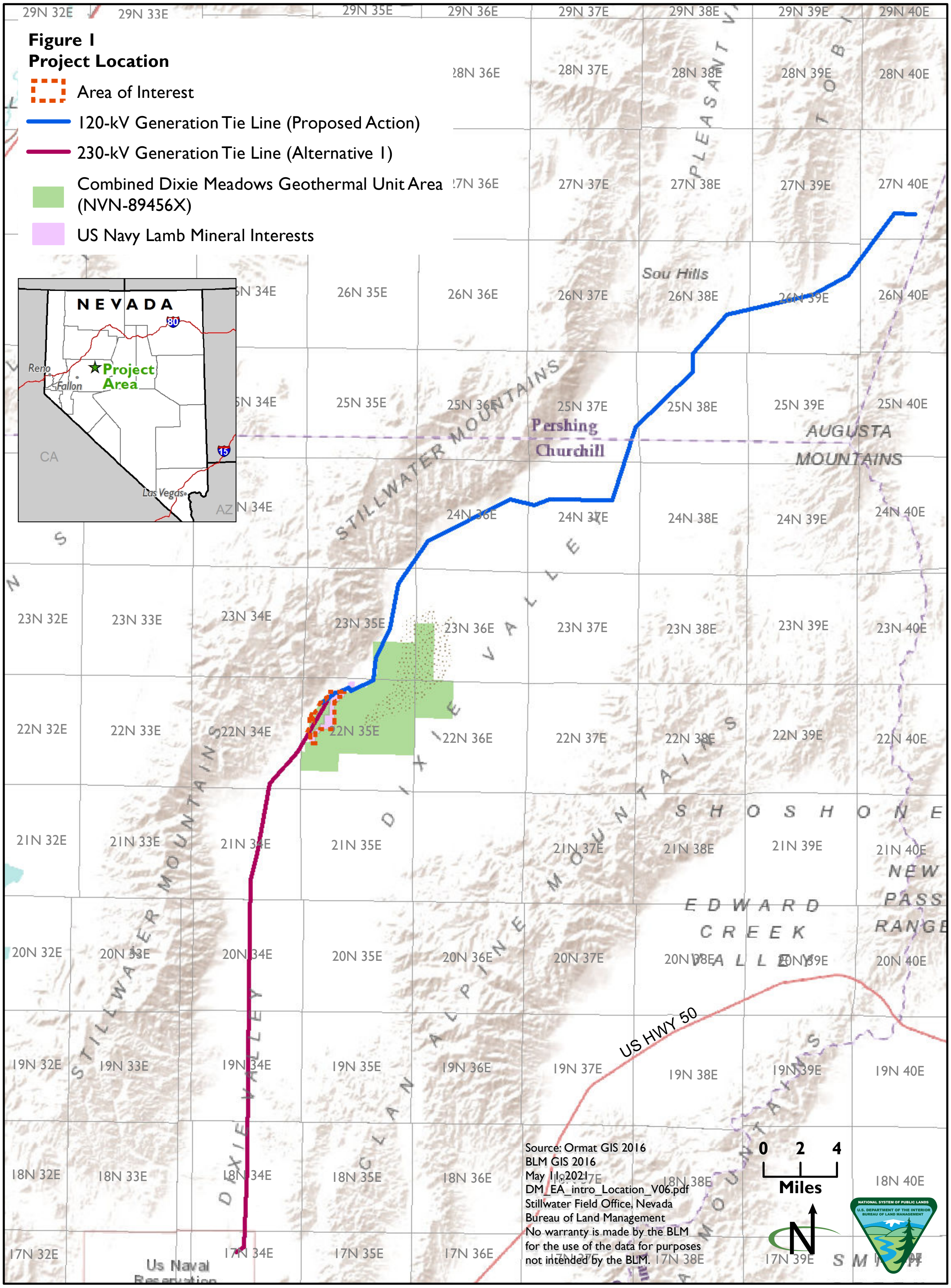
Figure 1
Project Location
Area of Interest
120-kV Generation Tie Line (Proposed Action)
230-kV Generation Tie Line (Alternative 1)
Combined Dixie Meadows Geothermal Unit Area (NVN-89456X)
US Navy Lamb Mineral Interests
NEVADA
Reno
Fallon
Project Area
CA
AZ
Las Vegas
80
15
STILLWATER MOUNTAINS
Sou Hills
PLEASANT VALLEY
AUGUSTA MOUNTAINS
Pershing
Churchill
DIXIE VALLEY
SHOSHONE MOUNTAINS
EDWARD CREEK VALLEY
NEW PASS RANGE
CLAN ALPINE MOUNTAINS
US HWY 50
Us Naval Reservation
29N 32E
29N 33E
29N 35E
29N 36E
29N 37E
29N 38E
29N 39E
29N 40E
28N 36E
28N 37E
28N 38E
28N 39E
28N 40E
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Source: Ormat GIS 2016
BLM GIS 2016
May 11, 2021
DM_EA_intro_Location_V06.pdf
Stillwater Field Office, Nevada
Bureau of Land Management
No warranty is made by the BLM for the use of the data for purposes not intended by the BLM.
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The proposed power plants and related wells and pipelines would be located in the AOI on geothermal leases that are on public lands administered by the BLM CCD, Stillwater Field Office, and a segment of lands whose surface is administered by the Department of the Navy (Navy). ORNI 32 owns the federal mineral estate for the Navy lands.

The northern gen-tie option would be located on lands not within the lease boundary, but on public lands administered by the BLM CCD, Stillwater Field Office and the BLM Winnemucca District Office, Humboldt River Field Office, and a portion of Navy lands. This northern gen-tie would have a voltage of 120 kV and a total constructed length of 48 miles. At the time of the May 2017 draft EA Proposed Action, ORNI 32 proposed to construct approximately 6,200 linear feet of the northern gen-tie alignment across an area containing a series of springs and associated wetlands and riparian vegetation in Township 22 North, Range 35 East, Sections 4, 5, and 8 in the northern portion of Dixie Meadows. ORNI 32 has since realigned the portion of the gen-tie that formerly crossed wetlands and riparian areas in Dixie Meadows. As analyzed in the revised draft EA, released in January 2021, and this EA, the proposed northern gen-tie alternative, as modified, would follow the existing Dixie Valley Road, outside of wetlands and riparian areas. The proposed northern gen-tie alignment, as modified, is described in **Section 2.1.5**.

The southern gen-tie option would be located entirely on public lands administered by the BLM CCD, Stillwater Field Office and Navy lands. The southern gen-tie option would have a voltage of 230 kV and extend approximately 31 miles. Approximately 26.7 miles of this line would be located within an area that has been temporarily segregated (initially for a period of 2 years) from all forms of appropriation under the public land laws, including the mining laws, mineral leasing laws, and geothermal leasing laws, subject to valid existing rights. The BLM segregated this area in response to an application received from the Navy to expand the area withdrawn for military use of the Naval Air Station Fallon, Fallon Range Training Complex in Churchill County, Nevada, under the 1958 Engle Act.[1] The segregation was in effect for a period of 2 years from September 2, 2016 (date of publication in the *Federal Register* at 81 *Federal Register* 58919), unless the application/proposal was cancelled or approved prior to that date, subject to valid existing rights. According to the BLM's September 2, 2016, *Federal Register* notice, "Licenses, permits, cooperative agreements, or discretionary land use authorizations may be allowed during the period of segregation, but only with the approval of the BLM Authorized Officer and, as appropriate, with the concurrence of the Navy" (81 *Federal Register* 60736).

Additionally, on August 31, 2018 (83 *Federal Register* 44654), Public Land Order No. 7873 extended the 2016 temporary segregation for a period of 4 years.

[1] For more information, refer to https://frtcmodernization.com/.

This order withdraws (segregates) 8,722.47 acres of federal lands in the Dixie Valley area from all forms of appropriation under the public land laws while the Navy's request for a permanent expansion of its withdrawal area is considered. This includes removing these lands from location and entry under the United States mining laws, and leasing under the mineral and geothermal leasing laws, subject to valid existing rights.

The proposed power plants would have a nameplate[2] capacity of up to 30 MW each. The power plants would utilize binary technology to produce electricity from the geothermal resource, and they would have air cooling. In a binary geothermal power plant, virtually no geothermal resource fluids are consumed or evaporated during the production of electricity, so the resource reservoir would not be drawn down. Air cooling means that no groundwater would be consumed in cooling the fluid for reinjection into the source reservoir. Geothermal production and injection wells, pipelines, roads, and associated facilities would be constructed to support the power plants.

The gen-tie facilities would connect the proposed Dixie Meadows geothermal power plant(s) into NV Energy's power grid so that electricity can be delivered to consumers. Under the northern routing option, the 120 kV gen-tie would originate at each plant's substation, extend about 48 miles to the northeast, and connect to an existing power line at Ormat's Jersey Valley Geothermal Power Plant. This gen-tie route would parallel the existing Oxbow power line for the first 16 miles, from the proposed plant sites to the Terra-Gen Dixie Valley Power Plant. From there to Jersey Valley, the remaining 32 miles would mostly follow existing gravel roads, up to the Jersey Valley plant where it would tie into an existing 120 kV transmission line. The gen-tie would be in both Churchill and Pershing Counties.

The southern gen-tie route under consideration as Alternative 1 in this EA would also connect the proposed Dixie Meadows geothermal power plant(s) into the NV Energy power grid, but it would be 230 kV in size and extend approximately 31 miles to the south. At its southern terminus, this gen-tie would connect to NV Energy's Fort Churchill to Gonder 230 kV line at the proposed Middlegate Substation.

As described in **Chapter 2**, Proposed Action and Alternatives, ORNI 32 would only construct and operate one gen-tie. However, each of the two alternate routes described in this section are analyzed in this EA.

1.1.1 Geothermal Leasing and Development

A federal geothermal lease grants the lessee the exclusive right to explore, drill for, and develop ("utilize") geothermal resources in the leased lands for a period of 10 years. The terms of the lease require the lessee to show a certain level of

[2] The maximum rated output of energy.

diligent efforts or expenditures toward developing the geothermal resources within the lease area by the end of the tenth year, or the lease will expire. If a lessee documents its diligent efforts to explore and drill for geothermal resources, the BLM will grant extensions of the lease term in 5-year increments. Diligent efforts to achieve a well capable of producing in commercial quantities (or, following achievement of a paying well, efforts to achieve actual production [i.e., utilization of the resource for electrical generation]) must be demonstrated and approved on an annual basis during an extended term, or the lease may be terminated.

Once a lease or unit area goes into "producing" status by merit of drilling a well deemed capable of production of geothermal resources in commercial quantities, that lease is entitled to successive extended terms in 5-year increments, for up to 35 years following the primary term (thus potentially allowing the lessee use of the resource for up to 45 years), if the diligent efforts requirements to get to utilization are accepted and documented annually. If committed to a unit, a lessee with a producible well can hold the other unit leases in a production status to prevent their expiration until they can be developed. If utilization of the geothermal resources (production of electricity) from a generating facility is achieved and continues, and the lands are not needed for another use, a renewal of the lease term shall be granted.

Geothermal exploration and production on federal leases are subject to lease terms and stipulations on use of the lands to protect other resource values and uses, and to comply with all applicable federal, state, and local laws and regulations pertaining to, for example, sanitation, water quality, wildlife, safety, and reclamation requirements, among others (see **Appendix A**, Geothermal Lease Stipulations). Lease stipulations apply lease-wide, where protected resources are present, and are derived from the terms, conditions, and decisions in the applicable land use plan, together with the environmental analysis process conducted (in accordance with the National Environmental Policy Act of 1969 [NEPA]) to support lease issuance. The mere issuance of a lease does not allow or guarantee the right to engage in surface-disturbing activities until the lessee applies for a permit to explore or drill, which may be granted, denied, or granted subject to site-specific conditions of approval, after the BLM conducts supporting NEPA compliance. The utilization stage of geothermal production is the final stage; approval of such plans are also subject to NEPA analysis and other applicable consultations or studies.

This EA considers the potential environmental impacts of the Proposed Action and alternatives and has been prepared in accordance with NEPA, the Council on Environmental Quality (CEQ) regulations implementing NEPA, and the Federal Lands Policy and Management Act of 1976 (FLPMA).

1.2 BACKGROUND

1.2.1 Past Leasing and Exploration Activities

The Combined Dixie Meadows Geothermal Unit Area (NVN-89456X) was created by combining the Dixie Hope and Dixie Meadows geothermal lease units. The unit also includes mineral rights to 760 acres of land used by the Navy known as the Lamb Mineral interests. Ormat owns and controls the Lamb Mineral interests.

Ormat acquired Terra-Gen Power's Dixie Hope leases in December 2010; on February 1, 2012, those portions of the Dixie Meadows and Dixie Hope lease blocks that remain of interest to Ormat were consolidated into the Combined Dixie Meadows Geothermal Unit Area (NVN-89456X). **Table 1** displays the leases held and their legal land descriptions.

Table 1
Leases within the Combined Dixie Meadows Geothermal Unit Area (NVN-89456X)

Lease Number	Section Number	Township, Range
NVN-60686	17, 18, 19, 20	T22N, R35E
NVN-60685	9, 10, 15, 16	T22N, R35E
Lamb Mineral Interests[1]	5, 8, 17, 18, 19	T22N, R35E
NVN-83934	1, 2, 3, 4, 8	T22N, R35E
NVN-83935	11, 12, 13, 14	T22N, R35E
NVN-83936	21, 22, 23, 24	T22N, R35E
NVN-83937	25, 26, 35, 36	T22N, R35E
NVN-83939	5, 6, 7, 8	T22N, R36E
NVN-83941	4, 17, 19, 20, 30, 31	T22N, R36E
NVN-86885	27, 29, 30	T22N, R35E
NVN-91823	3, 4, 18	T22N, R35E
NVN-92479	7, 8, 18	T22N, R35E
NVN-92717	18	T22N, R35E

Sources: Ormat GIS 2016; ORNI 32, LLC 2020
[1] Ormat owns the mineral rights for this land, along with the right to surface use in exercise of mineral rights. The Navy has rights to use of the land surface based on a withdrawal order.

Two EAs have been completed for lands within the Combined Dixie Meadows Geothermal Unit Area. Findings of no significant impact (FONSIs) and Decision Records for the TGP Geothermal Exploration EA (DOI-BLM-NV-C010-2010-0010-EA) and the Dixie Meadows Geothermal Exploration Project EA (DOI-BLM-NV-C010-2011-0516-EA) were signed in June 2010 and January 2012, respectively. Combined, the two EAs analyzed and permitted up to 34 well pads (with multiple wells on each pad), 205.6 acres of surface disturbance on BLM-administered lands, and 4 acres of surface disturbance on the Navy's Lamb Mineral interests. Two groundwater wells were also approved.

Since the two FONSIs and Decision Records were issued, Ormat has drilled nine wells (four full-size wells [42(12)-9, 23A-8, 24-8, and 14-8] and five slim wells [22D-8, 22-8B, 23-8, 24A-8, and 86-7]). The results of these wells indicate that geothermal resources are more likely to exist near the western margin of the valley. Consequently, Ormat obtained two additional geothermal lease areas (N-92479 and N-92717) on December 1, 2013, on the western side of the lease blocks, which extend up to the boundary with the Stillwater Range Wilderness Study Area (WSA) that is located west of the Dixie Valley Road. Details of geothermal exploration at Dixie Meadows since 2011 are in **Appendix L**.

Table 2 summarizes existing and previously permitted and approved wells in the geothermal unit area under the previous EAs. **Figure 2**, Existing and Permitted Wells, depicts the locations of these wells.

Table 2
Existing and Permitted Wells

Kettleman Well Number	UTM Coordinates[1]		Well Status	Well Type[2] and Depth (If Drilled)
	Easting	Northing		
Lamb Mineral Interests				
57-5	408429	4406136	Previously permitted, not drilled	Deep core hole/full-size well
58-5	408424	4405877	Previously permitted, not drilled	Core/slim hole/full-size well
Lease Number N-60685 T22N; R35E				
21-9	409586	4405668	Existing	Monitoring well MW-1; 472 feet
42(12)-9	409994	4405393	Existing	Full-size well; 7,442 feet
Lease Number N-60686 T22N; R35E				
11-17	407646	4404163	Previously permitted, not drilled	Deep core hole
Lease Number N-83934 T22N; R35E				
75-4	410549	4406437	Existing	Full-size well; forked completion (75-4; 5,000 feet, and 75-4ST1; 5,476 feet
71-3	412266	4407189	Previously permitted, not drilled	Deep core hole/full-size well
14-2	412714	4406660	Previously permitted, not drilled	Deep core hole/full-size well
25-3	411218	4406454	Previously permitted, not drilled	Deep core hole/full-size well
67-4	410306	4406077	Previously permitted, not drilled	Deep core hole/full-size well
Lease Number N-92479 T22N; R35E				
84-7	407504	4405053	Previously permitted, not drilled	Deep core hole
86-7	407326	4404615	Existing	Core hole; 1,000 feet
86A-7	407332	4404610	Previously permitted, not drilled	Full-size well
22-8b	407743	4405476	Existing	Core hole; 1,000 feet
22-8a	407918	4405570	Previously permitted, not drilled	Core hole; 1,000 feet depth
22C-8	407886	4405488	Previously permitted, not drilled	Full-size well
22D-8	407748	4405482	Existing	Core hole; 4,025 feet
31-8	407955	4405593	Previously permitted, not drilled	Core hole; 1,000 feet depth

Kettleman Well Number	UTM Coordinates[1]		Well Status	Well Type[2] and Depth (If Drilled)
	Easting	Northing		
23-8	407925	4405330	Existing	Deep core hole; 4,700 feet
23A-8	407890	4405291	Existing	Full-size well; 4,758 feet
24-8	407734	4404988	Existing	Full-size well; 3,060 feet (deepened on redrill [24-8RD2] to 4,800 feet)
24A-8	407724	4404983	Existing	Core hole; 750 feet
17-8	407578	4404429	Previously permitted, not drilled	Full-size well
14-8	407653	4405114	Existing	Full-size well; 535 feet

Source: Ormat GIS 2016

[1] UTM (Universal Transverse Mercator) coordinates are in North American Datum of 1983 UTM 11N (meters)
[2] Well types are as follows:

- Core holes are wells that are drilled using a hollow drill bit; whole rock samples (cores) can be extracted from the core holes drilled this way. They are not designed for production and do not contact or directly test the geothermal resource. They are approved with a Notice of Intent to Conduct Geothermal Exploration Operations (NOI) under 43 Code of Federal Regulations (CFR) Subpart3250.
- Deep core holes are cores drilled to a relatively greater depth.
- Slim hole wells are intended to contact, test, and confirm the resource by providing direct evidence of the presence of a geothermal resource. Approved with a geothermal drilling permit under 43 CFR Subpart 3260, they are usually about 6 to 9 inches in diameter, and they are not intended for production. Some wells are used for observation over the long term, or they can be converted to injection wells.
- Full-size wells are drilled to a wider diameter than core holes or slim hole wells (usually 12 inches or more in diameter at the bottom), allowing for either production or injection use, depending on observed well characteristics.
- Monitoring wells are wells used for monitoring various characteristics of water resources.

Ormat also performed a 46-day flow and injection test from April 27 to June 11, 2017. Locations of test wells, observation wells, springs, and faults are shown in Figure 14B M0 in **Appendix M**. The drilling and testing authorized under the EA have informed this EA.

1.3 Purpose and Need

The purpose of the Proposed Action is to decide whether to approve or deny ORNI's 32's utilization plan, and if approved, what conditions of approval should apply in allowing ORNI 32 to develop the geothermal resources within the Dixie Meadows Geothermal Unit Area on public lands administered by the BLM that are leased to ORNI 32.

The need for the Proposed Action is established by the BLM's responsibility under the Geothermal Steam Act of 1970, the regulations under 43 CFR Part 3200, and Secretarial Order 3285 of March 11, 2009. The BLM is obligated to respond to and process a lessee's submitted permit applications to develop existing leases, such as the plan for utilization and plan of development (**Appendix I**) for the proposed project.

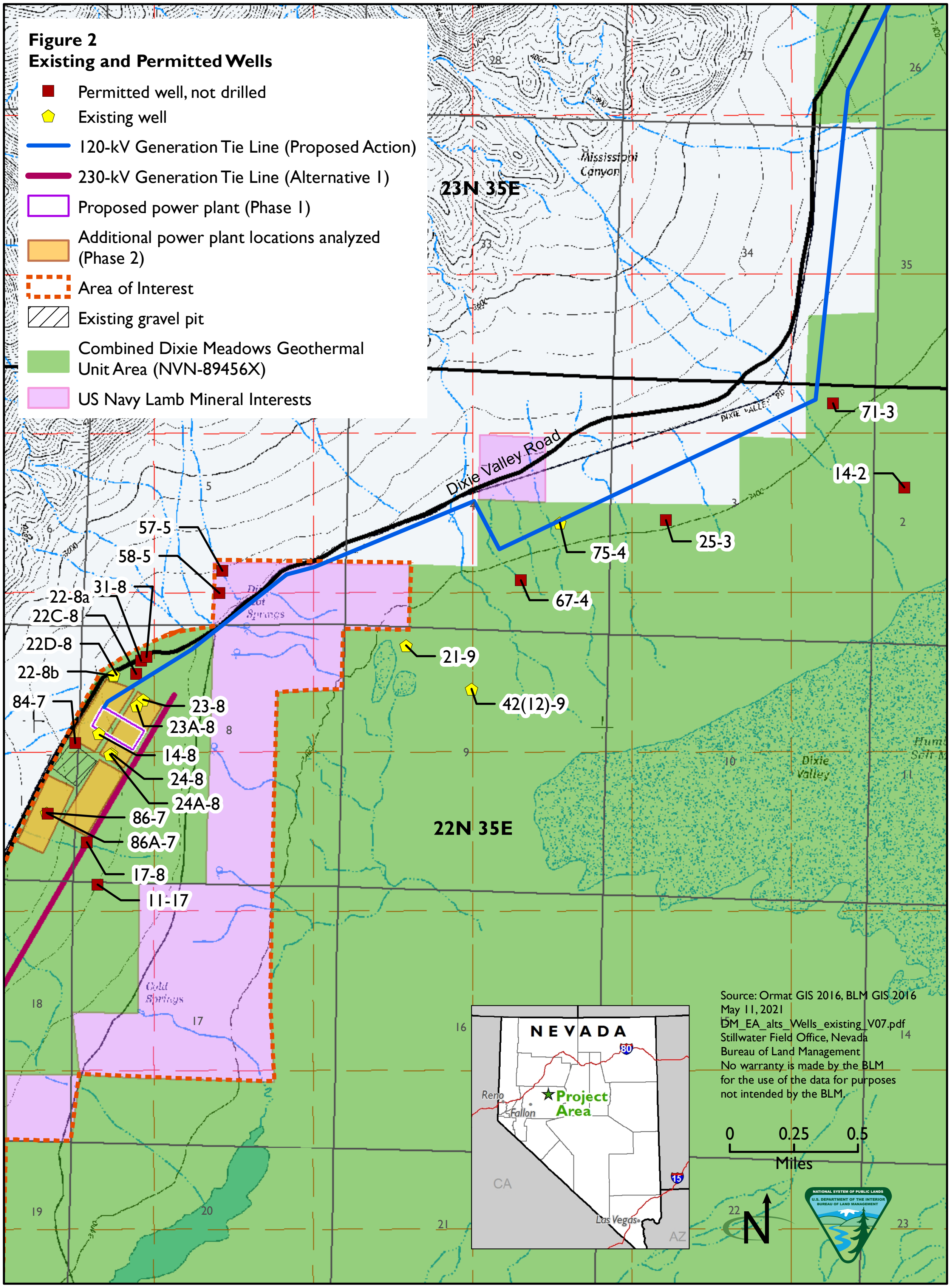

Figure 2
Existing and Permitted Wells
Permitted well, not drilled
Existing well
120-kV Generation Tie Line (Proposed Action)
230-kV Generation Tie Line (Alternative 1)
Proposed power plant (Phase 1)
Additional power plant locations analyzed (Phase 2)
Area of Interest
Existing gravel pit
Combined Dixie Meadows Geothermal Unit Area (NVN-89456X)
US Navy Lamb Mineral Interests
23N 35E
22N 35E
Mississippi Canyon
Dixie Valley Road
Dixie Valley
71-3
14-2
75-4
25-3
67-4
57-5
58-5
31-8
22-8a
22C-8
22D-8
22-8b
84-7
23-8
23A-8
14-8
24-8
24A-8
86-7
86A-7
17-8
11-17
21-9
42(12)-9
Cold Springs
NEVADA
Reno
Fallon
Project Area
Las Vegas
CA
AZ
Source: Ormat GIS 2016, BLM GIS 2016
May 11, 2021
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Bureau of Land Management
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In addition, states across the western US have adopted renewable portfolio standards that require electricity providers to obtain a certain percentage of power from renewable energy resources.[3] Nevada's renewable portfolio standard requires that the state's utilities procure 50 percent of their energy from renewable sources by 2030. Production from the proposed facilities is also expected to aid the state of California in meeting its own renewable portfolio standards. The BLM is committed to implementing the Biden Administration's Executive Order 14008, which supports clean energy and the reduction of climate impacts by moving away from fossil fuel as a source of utility-scale energy. This proposed Dixie Meadows utilization project aids in achieving these policy goals. Additionally, unlike wind or solar power, geothermal energy provides a baseline source of power, which contributes to the availability of clean energy 24 hours per day, 7 days per week. The acres of surface disturbance per megawatt are typically smaller for geothermal compared with wind and solar energy facilities.

1.4 LAND USE PLAN CONFORMANCE STATEMENT

The Proposed Action and alternatives described below are in conformance with the *Carson City Field Office Consolidated Resource Management Plan* (CRMP),[4] as amended by the Record of Decision (ROD) and Resource Management Plan (RMP) Amendments for the *Final Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States* (2008) (PEIS),[5] and the *Winnemucca District Resource Management Plan*.[6] The desired outcome for minerals and energy management under the CRMP, page MIN-1, is to "encourage development of energy and mineral resources in a timely manner to meet national, regional, and local needs consistent with the objectives for other public land uses" (BLM 2001). The CRMP minerals and energy management direction applies the following restriction on geothermal leasing: "No Surface Occupancy (NSO) 1. Within 500 feet of any water" (BLM 2001). The Proposed Action is in conformance with this measure.

1.4.1 Greater Sage-Grouse Land Use Plan Amendments

The CRMP has also been amended by the Nevada and Northeastern California Greater Sage-Grouse Approved Resource Management Plan Amendment (BLM 2015a).[7] The Record of Decision and Approved Resource Management Plan Amendments for the Great Basin Region (henceforth referred to as the "2015 Decision"; BLM 2015a), including the Greater Sage-Grouse Sub-Region of Nevada and Northeastern California, were signed on September 21, 2015, by the Director

[3] Renewable energy sources such as geothermal, solar, wind, and hydropower do not require the burning of fossil fuels to generate electricity.
[4] The CRMP is available at: https://eplanning.blm.gov/public_projects/lup/77963/129016/156971/2001_CC_CONSOLIDATED.RMP.pdf.
[5] The ROD and PEIS are available at: https://www.blm.gov/sites/blm.gov/files/ROD_Geothermal_12-17-08.pdf
[6] The Winnemucca RMP is available at: https://eplanning.blm.gov/eplanning-ui/project/47537/570
[7] The Approved Greater Sage-Grouse Plan Amendment is available at: https://eplanning.blm.gov/public_projects/lup/103343/143707/176908/NVCA_Approved_RMP_Amendment.pdf.

of the BLM and the Assistant Secretary of Land and Minerals Management. This 2015 Decision, in conjunction with the approved RMPs and approved RMP amendments, constitutes BLM land use planning decisions to conserve the greater sage-grouse and its habitats throughout its remaining range that is located on public lands administered by the BLM. The efforts of the BLM, in coordination with the Forest Service on National Forest System lands within the remaining range of the species, constitute a coordinated strategy for conserving the greater sage-grouse and the sagebrush-steppe ecosystem on most federal lands on which the species depends. The Proposed Action has components that fall within areas mapped as other habitat management areas (OHMA).

In 2019, the BLM released the *Nevada and Northeastern California Greater Sage-Grouse Resource Management Plan Amendment*, which updated the 2015 Greater Sage-Grouse habitat maps (BLM 2019a). In October 2019, the US District Court for the District of Idaho issued a preliminary injunction that suspends implementation of the 2019 *Greater Sage-Grouse RMP Amendment*, including in Nevada and Northeastern California. As a result, the 2015 *Greater Sage-Grouse RMP Amendment*, including the habitat mapped therein, remains in effect until the injunction is resolved.

Appendix B of the 2015 Decision states that impact evaluations on greater sage-grouse leks are required for actions requiring NEPA analysis. The appendix states minimum lek buffer distances for various activities, including surface disturbance, human activities, and natural vegetation removal (3.1 miles); infrastructure related to energy development (3.1 miles); and tall structures such as transmission towers and lines (2 miles). The nearest pending lek is approximately 3.7 miles from the northern gen-tie alignment. Additionally, there is one lek with an unknown status, and one pending lek located approximately 4.5 and 5 miles from the northern gen-tie alignment, respectively.

Appendix C of the 2015 Decision states that required design features (RDFs) are required for certain activities in all greater sage-grouse habitat. RDFs establish the minimum specifications for certain activities to help mitigate adverse impacts. The RDFs are included as **Appendix B** of this EA (Greater Sage-Grouse Required Design Features). Project components are in conformance with the amended RMP through incorporation of the applicable RDFs (see **Appendix B**) within greater sage-grouse OHMA. RDFs do not apply in greater sage-grouse non-habitat areas.

Appendix G of the 2015 Decision lists fluid mineral stipulations in greater sage-grouse habitat. The Proposed Action would comply with applicable stipulations, including:

- SG-08-CSU: limiting noise at leks during the breeding season (March 1 to May 15)
- SG-09-CSU: applying lek buffer distances

Appendix M of the 2015 Decision recommends a general protocol for noise measurements in areas of existing and proposed development in greater sage-grouse habitat areas. The protocol was written to facilitate the gathering of noise measurements relevant to stipulations for greater sage-grouse protection. In summary, the protocol requires data collection by qualified personnel, using high-quality, calibrated equipment and following a set of standardized data collection procedures. The Proposed Action would comply with the noise protocol in greater sage-grouse OHMA and lek buffer areas, as applicable.

The Proposed Action is also in compliance with applicable terms, conditions, and decisions in Special Status Species, Leased Fluid Minerals, and Land Use Authorizations Management Decisions outlined in Section 2.2 of the 2015 Decision.

1.5 Relationship to Laws, Regulations, Policies, Plans, and Other Environmental Analyses

The Proposed Action is consistent with federal laws and regulations; state and local government laws and regulations; and other plans, programs, and policies to the extent practicable within federal law, regulation, and policy. Specific approvals and permits would be required for constructing, operating, and maintaining the proposed geothermal project.

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

- NEPA, as amended (Public Law 91-190, 42 USC, 4321 [et seq.])
- 40 CFR Part 1500 (et seq.), CEQ Regulations for Implementing the Procedural Provisions of NEPA[8]
- Considering Cumulative Effects under NEPA (CEQ 1997)
- 43 CFR Part 46, DOI Implementation of NEPA of 1969; Final Rule, effective November 14, 2008
- DOI requirements (Departmental Manual 516, Environmental Quality; DOI 2008)
- BLM NEPA Handbook (H-1790-1), as updated (BLM 2008a)
- The Geothermal Steam Act of 1970, as amended (30 USC 1001–1028)
- 43 CFR Part 3200, Geothermal Resources Leasing and Operations; Final Rule, May 2, 2007, as amended in September 2007 and September 2009

[8] This EA was developed prior to the updated CEQ regulations, which took effect on September 14, 2020.

- The Energy Policy Act of 2005, Subtitle B (Public Law 109-58, August 8, 2005);
- The National Energy Policy, Executive Order 13212 (May 2001)
- Best management practices (BMPs) as defined in *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, Fourth Edition* (Gold Book; BLM 2007a)
- The Geothermal Energy Research, Development, Demonstration Act of 1974
- The Federal Land Policy and Management Act of 1976 (Public Law 94 579, 43 USC 1761 [et seq.])
- Rights-of-Way (ROWs) under the FLPMA (43 CFR 2800), final Rule, April 22, 2005 (amended October 31, 2008, and December 19, 2016)
- Federal Noxious Weed Act of 1974 (7 USC 2801)
- National Historic Preservation Act of 1966, as amended (54 USC 300101 *et seq.;* formerly 16 USC 470)
- The American Indian Religious Freedom Act of 1978 (42 USC 1996)
- The Native American Graves Protection and Repatriation Act (25 USC 3001)
- BLM Manual 1737, Riparian – Wetland Area Management
- BLM Manual 7240, Water Quality Manual
- BLM Manual 7250, Water Rights Manual
- BLM Manual 1794, Mitigation
- The Act of July 31, 1947, as amended (30 USC, Sections 601 et seq.; The Material Sale Act)
- Executive Order 11990, Protection of Wetlands (May 24, 1977)
- Section 304 of FLPMA (43 USC 1734) and the Independent Offices Appropriation Act of 1952 (31 USC 9701), regarding collection of fees and reimbursement of costs
- August 26, 2016, 81 *Federal Register* 58919, Notice of Intent to Prepare an Environmental Impact Statement and to Announce Public Scoping Meetings for the Fallon Range Training Complex Modernization: Expansion of Land Ranges, Airspace Modifications, and Public Land Withdrawal Renewal
- August 31, 2018, 83 *Federal Register* 44654, Public Land Order No. 7873; Withdrawal of Public Land for Land Management Evaluation Purposes: Nevada

The Proposed Action is consistent with State of Nevada, and Churchill County and Pershing County ordinances, policies, and plans.

1.5.1 Relationship to Other Environmental Analyses

Multiple environmental analysis documents have been prepared for exploration activities in the Dixie Valley Geothermal Unit Area and for geothermal leasing in this area. These documents are listed below and are incorporated by reference in this document where applicable.

- Fluid Mineral Leasing within Six Areas of Churchill, Lyon, Mineral, and Nye Counties, Nevada on the Carson City District, DOI-BLM-NV-C010-2014-0013-EA; April 2014 (BLM 2014; http://bit.ly/1RjhaQx)
- Record of Decision and Resource Management Plan Amendments, Programmatic Environmental Impact Statement (PEIS) for Geothermal Resources Leasing in the Western United States (BLM 2008b) available at: https://www.blm.gov/sites/blm.gov/files/ROD_Geothermal_12-17-08.pdf), which amended the 2001 CRMP.
- Ormat Technologies, Inc., Dixie Meadows Geothermal Exploration Project EA, DOI-BLM-NV-C010-2011-0516-EA; January 2012 (BLM 2011; http://bit.ly/2lfCZc8)
- TGP Dixie Development Company, LLC Coyote Canyon and Dixie Meadows Geothermal Exploration, DOI-BLM-NV-C010-2010-0010-EA; May 2010 (BLM 2010; available at the BLM Carson City Office for review during normal business hours)

In 2008, the BLM completed the PEIS for Geothermal Leasing in the Western United States (BLM 2008b). This PEIS was the foundation for a ROD and Resource Management Plan Amendments for Geothermal Resources Leasing in the Western United States (BLM 2008c). This ROD amended BLM resource management plans, including the CRMP (BLM 2001), to identify public lands that are administratively and legally closed or open to leasing and to develop a comprehensive list of stipulations, BMPs, and procedures to serve as consistent guidance for future geothermal leasing and development. Special stipulations developed in the ROD were applied to geothermal resource leases subsequently issued by the BLM, including the federal geothermal leases issued to or acquired by Ormat within the Dixie Valley Geothermal Unit Area. BMPs from the ROD are included as **Appendix F** of this EA.

Full copies of geothermal lease stipulations are included as **Appendix A** to this EA; the lease stipulations are also summarized in **Appendix J**. ORNI 32 is required to comply with all lease stipulations.

1.5.2 Regulatory Permits and Approvals

The Proposed Action may be subject to other applicable permits listed in **Table 3**, below. ORNI 32 would comply with all permitting requirements.

Table 3
Potential Regulatory Permits and Approvals

Regulatory Agency	Authorizing Action
BLM and Navy	• Decision Record • Right-of-way • Navy concurrence
BLM	• Geothermal drilling permit • Permit to construct power plant(s) • Geothermal site license • Geothermal commercial use permit
US Army Corps of Engineers	Section 404 Clean Water Act permit
Nevada Division of Minerals	Permit to Drill an Oil and Gas and Geothermal Well
Nevada Public Utilities Commission	Utility Environmental Protection Act permit (if 230 kV gen-tie is selected)
Nevada Division of Environmental Protection (NDEP) – Bureau of Water Pollution Control	• Stormwater industrial general permit • De minimis discharge general permit • Pesticide general permit • Drainage well general permit • Temporary permit for discharges to groundwaters of the State • Working in waters permit • Wastewater discharge permits • Underground injection control (UIC) permits • On-site sewage disposal system permits • Holding tank permits
NDEP – Bureau of Water Quality Planning	Section 401 Water Quality Certification
NDEP – Bureau of Air Pollution Control (BAPC)	Air quality operating permit
NDEP – BAPC	Surface area disturbance permit
Nevada Division of Water Resources – State Engineer	Permitting pursuant to Nevada Revised Statutes Chapters 533 and 534, including: • Temporary consumptive water use permit • Well permits • Dam safety permits
Nevada Department of Conservation and Natural Resources, Sagebrush Ecosystem Program	Nevada Conservation Credit System (Nevada Revised Statues Chapter 232.162)
BLM, Nevada Division of Historic Preservation and Archaeology	Section 106 compliance with the National Historic Preservation Act
Churchill County	Special use permit
Pershing County	Special use permit

1.6 Decision to Be Made

The BLM Authorized Officer would decide whether to approve ORNI 32's proposed Dixie Meadows Geothermal Utilization Plan (Ormat 2021). If the BLM Authorized Officer decides to approve the plan, the decision would also need to be made as to which gen-tie route would be approved and what terms and conditions would be applied to the permit. Concurrence from the Navy would be strongly desired as the gen-tie routes cross Navy lands.

1.7 Public Involvement and Changes from the Draft Environmental Assessment

The BLM released a draft EA on May 9, 2017.[9] The BLM received 664 individual comment submissions on the initial draft EA, of which 643 were form letters that had nearly identical content. Comments were submitted by state and federal agencies, the Fallon Paiute-Shoshone Tribe (FPST), nongovernmental organizations, and private citizens. Commenters mostly expressed concern regarding the potential impacts of the proposed geothermal development project on nearby hydrologic resources and aquatic habitats that support endemic species, such as Dixie Valley Hot Springs, which is a sacred site recorded as eligible for the National Register of Historic Places (NRHP).

Comments taken from the first comment period were taken into consideration and incorporated for the revised EA, and another public comment period was conducted for the development of the final EA. The BLM worked continuously with the technical working group (see **Appendix N**) on the documents. Based on the comments received on the May 2017 draft EA, the BLM's subsequent coordination with cooperating agencies and ORNI 32, and the BLM's government-to-government consultation with the FPST, the BLM revised the EA and published a second draft EA on January 13, 2021. For the second draft EA, a contractor prepared an aquatic resource monitoring and mitigation plan (ARMMP), which includes a conceptual hydrogeologic model, and a proposed aquatic resources monitoring and mitigation plan (see **Appendix H**).

The BLM received additional comments from local, state, and federal agencies; the FPST; and a nongovernmental organization on the second draft EA. Commenters requested changes to the EA and ARMMP to provide enhanced monitoring and mitigation to avoid impacts on aquatic habitat. Commenters also requested the project include additional measures to avoid impacts on cultural, tribal, and other resources. Comment and responses are in **Appendix G**.

This EA reflects changes made in response to comments, subsequent coordination with partner agencies and consultation with the FPST (see **Sections 5.1 and 5.2**), and new science. For example, since the release of the second draft EA, the US Geological Survey (USGS) (Halstead et al. 2021)

[9] Preparation of the initial EA was conducted by BLM staff and managers that are no longer with the Stillwater Field Office. Current BLM staff is unsure if initial public scoping was conducted for this project.

published a paper expanding the scientific understanding of the Dixie Valley toad and its habitat requirements. The findings from that study are included in **Sections 3.8 and 3.9**.

Based on comments received and subsequent coordination with partner agencies and consultation with the FPST, the BLM worked with ORNI 32 to revise and clarify the scope of the Proposed Action. Specifically, the Proposed Action, as reflected in the utilization plan (**Appendix I**) proposes drilling up to 32 wells on a maximum of 18 well pads (see **Sections 2.1.1** and **2.1.2**). Potential well locations under the Proposed Action are depicted in **Figure 3**.

There are also changes to **Sections 3.3.2**, **3.8.2**, and **3.9.2** to further describe the environmental impacts of the Proposed Action on groundwater, springs and seeps, and sensitive wildlife species. Specifically, groundwater, spring and seep, and geothermal resource monitoring would allow for early detection of potential changes to the groundwater and surface water quality, quantity, and temperature. Monitoring and subsequent mitigation measures described in **Appendix H**, combined with the implementation of BMPs and environmental protection measures (EPMs) in **Appendix J**, would minimize or mitigate any impacts on springs and associated species, such as the Dixie Valley toad.

The revised ARMMP (**Appendix H**) includes additional proposed groundwater and geothermal monitoring locations and water monitoring and mitigation protocols.

The new **Appendix L** documents historical geothermal exploration data collected since 2011. The new **Appendix M** describes the results of the flow testing Ormat conducted in 2017.

Chapter 5, Consultation and Coordination, is also revised to include more information on tribes, agencies, groups, and individuals contacted during the NEPA process, specifically the details of government-to-government consultation the BLM conducted with the FPST.

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Chapter 2.
Proposed Action and Alternatives

The Proposed Action and the alternative (Alternative 1) presented below differ only in the routing of the gen-tie. Currently, the Proposed Action (northern gen-tie route) has lower connection costs, but it has other interconnection challenges. The southern gen-tie route proposed under Alternative 1 is shorter, but it has greater costs due to the need for a transformer at the interconnection site. From an economic and transmission interconnection perspective, the northern gen-tie route, as described in the Proposed Action, is the preferred alternative.

2.1 PROPOSED ACTION (18 WELLS, TWO 30 MW PLANTS, AND NORTHERN GEN-TIE ROUTE)

The AOI consists of approximately 1,530 acres of public lands administered by the BLM in the Combined Dixie Meadows Geothermal Unit Area (NVN-89456X; see **Figure 1 and 3**). The AOI also includes the 760 acres of Navy land known as the Lamb Mineral interests, which are also in the geothermal unit area. Information describing the Proposed Action are from the Revised Utilization Plan (Ormat 2021) and the Plan of Development and ROW Application (ORNI 32, LLC 2020), which are included as **Appendix 1** of this EA.

The Proposed Action includes the following components:

- Construction and operation of up to two 30 MW net rated geothermal power plant facilities (16 acres each) and associated electrical substations;
- Construction of up to 18 well pads (1.5 acres each in size after interim reclamation);
- Construction and operation of up to three geothermal production and injection wells, core holes, or slim hole wells at each of the well pads, pipelines, access roads, and support facilities; and

- Construction and operation of a 120 kV gen-tie transmission line north to Ormat's Jersey Valley Power Plant.

Figure 3, Proposed Action and Alternative 1, displays the well pad locations and relative footprint size of potential power plants. To allow development flexibility, more potential power plant sites are proposed than would be used (a maximum of two 30 MW plants would be constructed and operated; each power plant would occupy a footprint of approximately 16 acres). The actual number of wells that would ultimately be completed would depend on the properties of the geothermal resource. Up to three wells (production, injection, or exploration well) may be drilled on a single pad; however, no more than 18 pads would be constructed. For context, **Figure 4**, Existing, Permitted, and Proposed Features, depicts the Proposed Action relative to existing and permitted (not drilled) wells.

Because of its scale, the gen-tie route is displayed in **Figure 5**, Gen-Tie Route—Proposed Action

Table 4, below, summarizes the proposed new facilities with an estimated area of permanent and temporary disturbance for each facility.

Table 4
Area of Surface Disturbance (Proposed Action)

Disturbance Type	Amount of Disturbance (Approximate Acres)	Amount of Disturbance to Be Reclaimed (Approximate Acres)	Amount of Disturbance that Would Not Be Reclaimed (Approximate Acres)
Well pads (production, injection, slim hole wells or core holes)	54	27	27
Power plants and substation	32	0	32
Gen-tie	1,808	1,796	12
Access roads/pipelines	40	0	40
Total	**1,934**	**1,823**	**111**

Source: Ormat GIS 2016

ORNI 32 must comply with any lease stipulations (see **Appendix A**) or conditions of approval that may be imposed by the BLM, and would implement applicable environmental protection and mitigation measures, which are outlined in **Appendix J** of this EA. Throughout project construction, operation, and maintenance, ORNI 32 would comply with geothermal lease stipulations. In addition, an invasive plant management plan and reclamation plan would be developed prior to construction, as described in **Appendix J**.

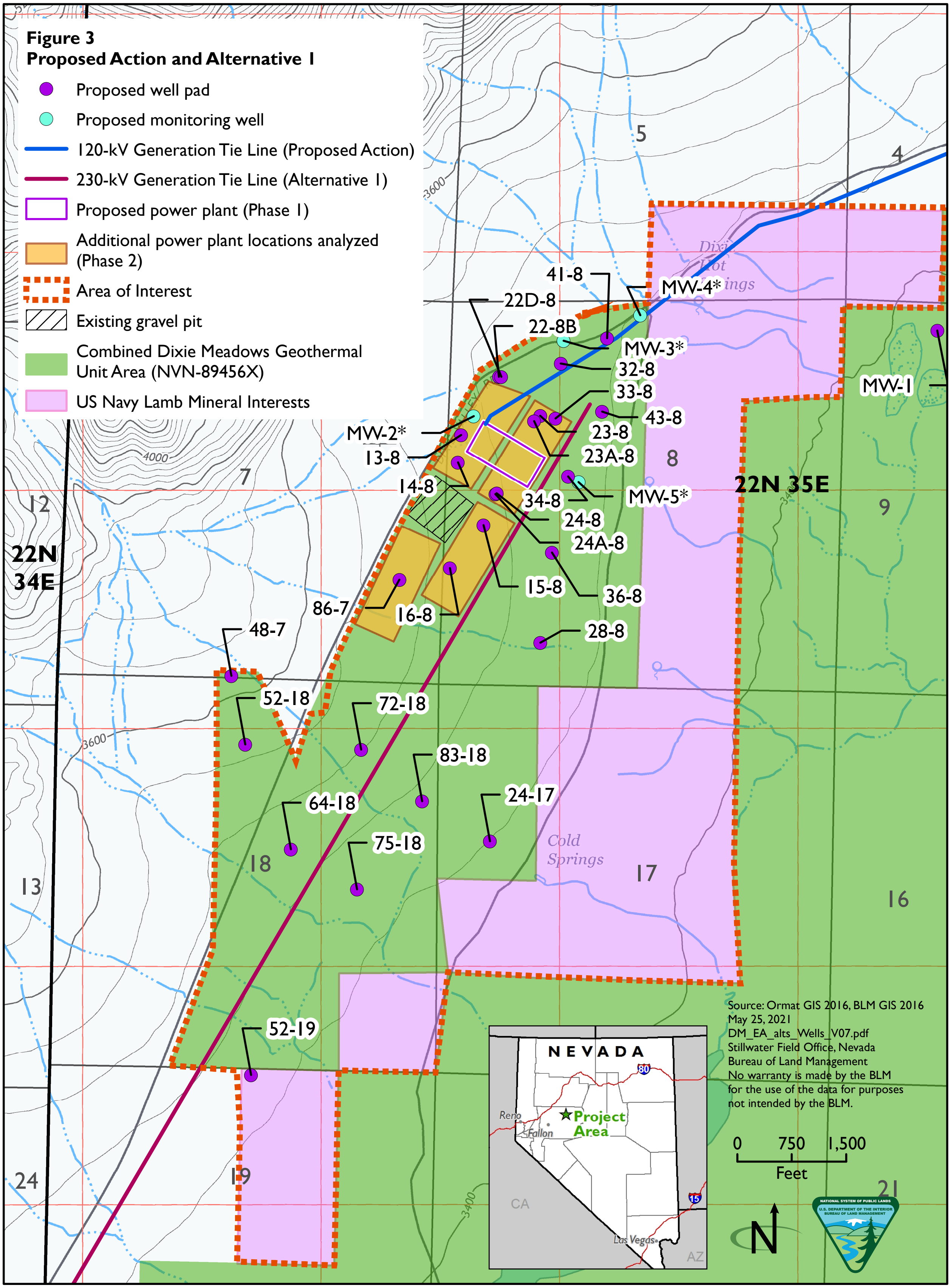

Figure 3
Proposed Action and Alternative 1

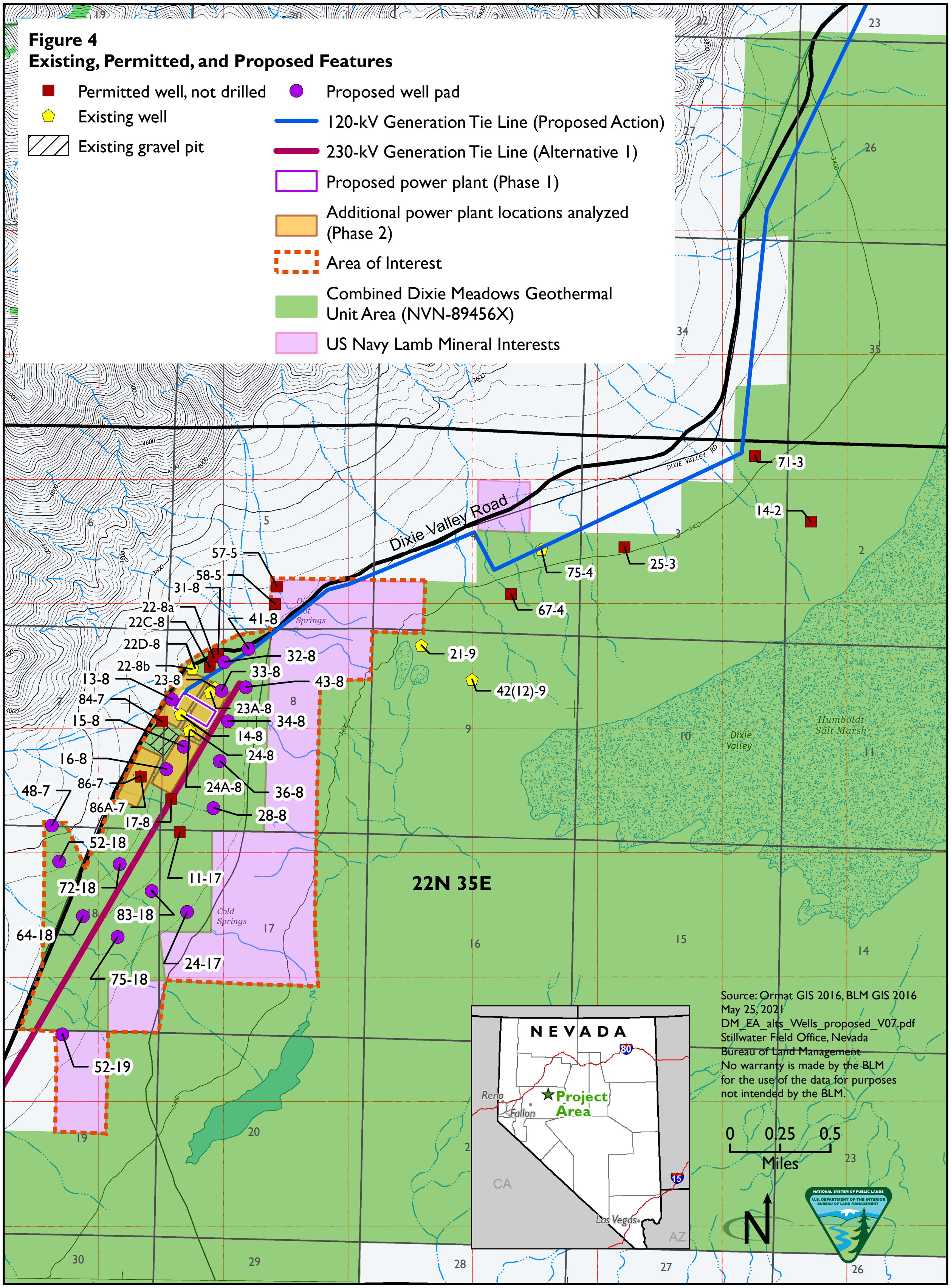

Figure 4
Existing, Permitted, and Proposed Features

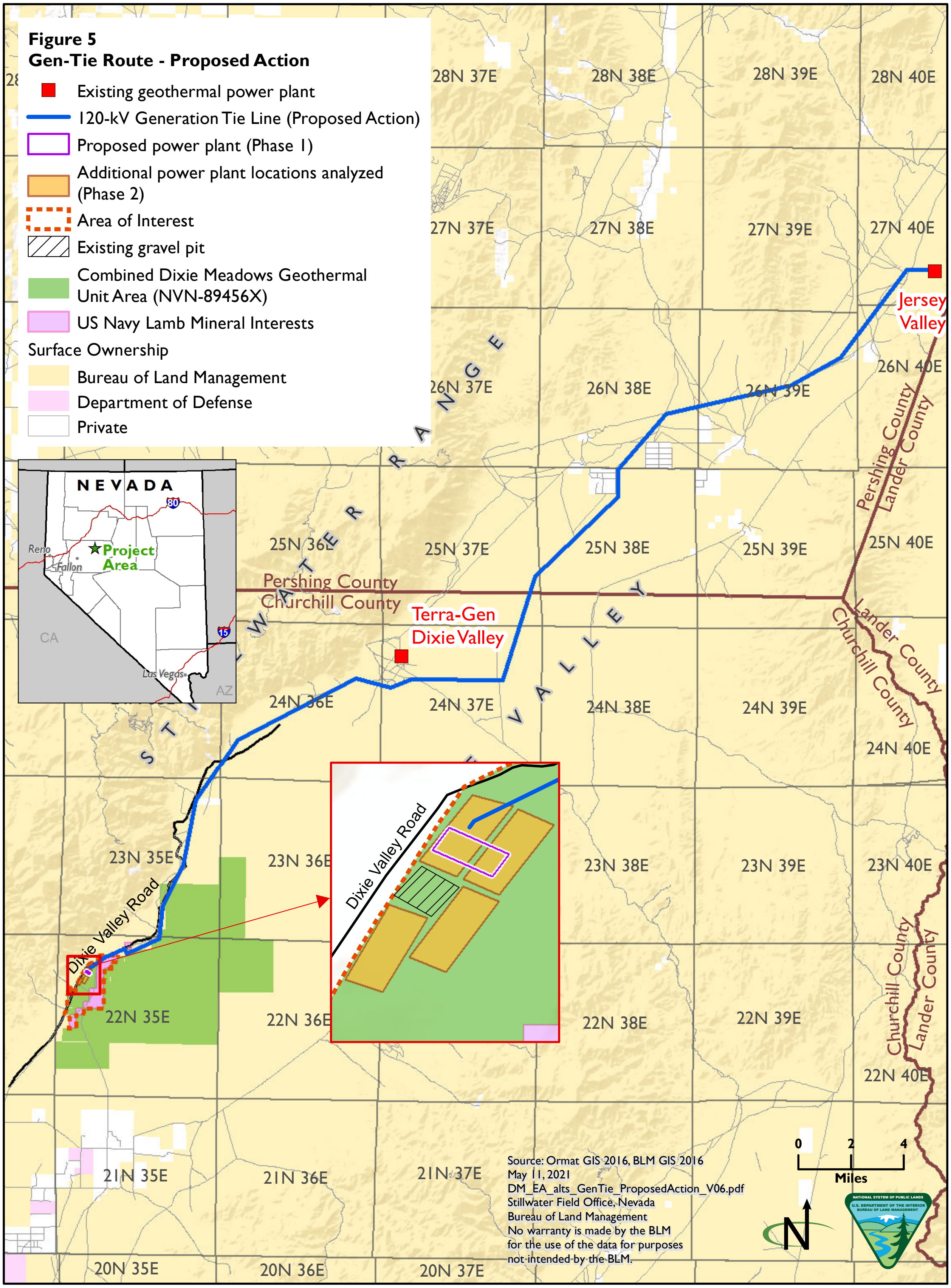
Figure 5
Gen-Tie Route - Proposed Action
Existing geothermal power plant
120-kV Generation Tie Line (Proposed Action)
Proposed power plant (Phase 1)
Additional power plant locations analyzed (Phase 2)
Area of Interest
Existing gravel pit
Combined Dixie Meadows Geothermal Unit Area (NVN-89456X)
US Navy Lamb Mineral Interests
Surface Ownership
Bureau of Land Management
Department of Defense
Private
NEVADA
Project Area
Reno
Fallon
CA
Las Vegas
AZ
Jersey Valley
Terra-Gen Dixie Valley
Pershing County
Churchill County
Lander County
STILLWATER RANGE
DIXIE VALLEY
Dixie Valley Road
28N 37E
28N 38E
28N 39E
28N 40E
27N 37E
27N 38E
27N 39E
27N 40E
26N 37E
26N 38E
26N 39E
26N 40E
25N 36E
25N 37E
25N 38E
25N 39E
25N 40E
24N 36E
24N 37E
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20N 36E
20N 37E
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Miles
N
Source: Ormat GIS 2016, BLM GIS 2016
May 11, 2021
DM_EA_alts_GenTie_ProposedAction_V06.pdf
Stillwater Field Office, Nevada
Bureau of Land Management
No warranty is made by the BLM
for the use of the data for purposes
not intended by the BLM.

Existing drilling operation and emergency contingency plans are also in place, including a fire contingency plan, a spill or discharge contingency plan, and a hydrogen sulfide contingency plan (see **Appendix J**).

In coordination with the BLM and partner agencies, including the US Fish and Wildlife Service (USFWS), Nevada Department of Wildlife (NDOW), USGS, and the Navy, ORNI 32 has developed and would implement the ARMMP to avoid, minimize, and mitigate, as needed, effects on aquatic resources and special status species. The ARMMP is **Appendix H**.

To reduce the potential for impacts on birds and bats, ORNI 32 has prepared a bird and bat conservation strategy (BBCS) (see **Appendix C**, Bird and Bat Conservation Strategy).

The proposed project schedule and a detailed description of each component of the Proposed Action are provided in the following sections.

2.1.1 Schedule of Activities

Proposed New Wells

ORNI 32 has completed 11 exploratory wells (four designed for production) under previously approved EAs described in **Section 1.2**, Background, and shown in **Figure 2** (Existing and Permitted Wells) and **4** (Existing, Permitted, and Proposed Features). **Figure 3** (Proposed Action and Alternative 1) shows new wells proposed to be drilled by ORNI 32, while **Figure 4** also includes planned drilling under existing approvals. This subsequent aspect of the project would follow the process outlined in **Section 2.1.2**, Proposed Drilling Activities and would be performed concurrently with similar exploration activities approved in the 2011 Exploration EA (BLM 2011). Drilling as permitted under the Decision Records for the two previous exploration EAs is ongoing to continue evaluating the geothermal resource in the area.

Power Plants and Production and Injection Wells

Construction of the power plants and initial well field facilities would require from 12 to 24 months once all permits are obtained and equipment orders are scheduled. Well construction could occur at any time over the life of the project, which is anticipated to be at least 30 years.

Gen-tie Transmission Line (Northern Route—Proposed Action)

Construction of the gen-tie would take approximately 5 months to complete. Construction would commence only after all required permits and authorizations have been secured. Construction would comply with any timing limitations or other protective restrictions imposed for migratory birds or greater sage-grouse.

2.1.2 Proposed Drilling Activities

The Proposed Action includes drilling of up to three wells per well pad on a maximum of 18 well pads. Proposed wells would include a combination of exploration and production/injection wells, as described below. Potential well pad locations under the Proposed Action are depicted in **Figure 3**. The locations of proposed well pads relative to existing and permitted wells are shown in **Figure 4**.

Core Holes and Slim Wells for Resource Confirmation and Testing[10]

The Proposed Action includes drilling of up to eight slim hole wells in the Dixie Meadows Geothermal Unit Area for resource confirmation and testing. The nature of these slim hole wells would be similar to the wells that were approved in the 2011 Exploration EA (DOI-BLM-NV-C010-2011-0516-EA; BLM 2011), though the exact locations would be different from those shown in the 2011 Exploration EA. The proposed locations of new wells under the Proposed Action will be within the proposed well pads as depicted in **Figure 3**. Typically, these test wells would be drilled at a diameter less than 6 inches, not designed for production, which requires a smaller drill pad than a full-size production or injection well. Each well would be situated on an approximately 150-foot by 150-foot drill pad (approximately 0.5 acres). Well pads used for test wells could be expanded later to accommodate full-size production or injection wells. Drilling a core hole or slim well typically occurs over a period of 4 to 10 weeks, depending on the depth, diameter, and resource conditions.

Site Preparation

Well pad preparation activities for test wells would include clearing, earthwork, drainage, and executing any other improvements necessary for efficient and safe operation and fire prevention. Only those well pads scheduled to be drilled would be cleared. Clearing would include removal of organic material and vegetation. Topsoil would be salvaged during the construction of all pads and new access roads, as feasible, and stockpiled on the pads for use during subsequent reclamation of the disturbed areas. Stockpiled topsoil would be seeded with a BLM-approved, weed-free seed mix to ultimately increase reclamation success. Construction of a well pad takes approximately 1 to 2 weeks to complete.

Fenced reserve pits would be constructed in accordance with BMPs identified in the BLM Gold Book (BLM 2007a) and the NDOW's *Design Features and Tools to Reduce Wildlife Mortalities Associated with Geothermal Sumps* (Geothermal Sump

[10] Core holes are wells that are drilled using a hollow drill bit; whole rock samples (cores) can be extracted from wells drilled this way. Deep core holes are cores drilled to a relatively greater depth.
Slim hole wells are typically less than 6 inches in diameter; they are used to measure geothermal gradients and pursue flow tests to assess the geothermal resource. Slim hole wells can be expanded later into full-size production wells.
Full-size wells are drilled to a wider diameter than slim hole wells or core holes, allowing for either production or injection use, depending on observed well characteristics.

Guidelines; NDOW, no date) on each pad for the containment and temporary storage of water, drill cuttings, and waste drilling mud during drilling operations. The reserve pit for test wells would measure approximately 20 feet by 50 feet by 8 feet deep.

Gravel for well pad and road building material would be obtained through a mineral material sales contract with the BLM. The gravel pit is located in T22N, R35E, Section 7, SE1/4 NE1/4 and Section 8 SW1/4 NW1/4, Mount Diablo Base and Meridian (see **Figure 3**). This sales contract (N-89405) expired on July 8, 2016, but ORNI 32 is currently in the process of renewing it.

Each well pad, exclusive of the reserve pit, would be covered with approximately 4 inches of gravel. An average of about 6 inches of gravel would be applied to the new access roads, as necessary, to create an all-weather, all-season surface.

Drilling

Each test well would be drilled with a rotary drill rig. During drilling, the top of the drill rig mast could be as high as 50 feet above the ground surface. The typical associated support equipment would include drill pipe, trailers, drill mud, fuel and water tanks, diesel generators and air compressors. Additional equipment and supplies would be brought to the drill site during ongoing drilling and testing operations.

The wells would each be drilled and cased to a design depth selected by the project geologist. Blowout prevention equipment, which is typically inspected and approved by the BLM and the Nevada Division of Minerals (NDOM), would be utilized while drilling below the surface casing. During drilling operations, cool water, salt, or barite (barium sulfate) would be stored at each well site for use in preventing uncontrolled well flow ("killing the well"), as necessary. If water for this purpose is stored in pits, pits would be fenced to prevent wildlife access.

The well bore would be drilled using nontoxic, temperature-stable drilling mud composed of a bentonite clay-water or polymer-water mix. Variable concentrations of standard, approved drilling additives would be added to the drilling mud as needed to prevent corrosion, increase mud weight, and prevent mud loss. Additional drilling mud would be mixed and added to the mud system as needed to maintain the required quantities.

Site Decommission

Following completion of exploration well testing, all drilling and testing equipment would be removed from the site, and interim reclamation would occur on areas of the well pad not needed for future well monitoring or testing. Interim reclamation would follow interim reclamation standards outlined in Appendix D, Best Management Practices – Mitigation Measures, of the BLM's 2008 geothermal leasing PEIS (see **Appendix F**). ORNI 32 would develop interim reclamation plans prior to construction. The surface facilities remaining on the site would likely consist only of several valves on top of the surface casing, which would be chained and locked to allow access in case additional testing is desired.

After the well drilling and testing operations are completed, the reserve pits would remain fenced with wildlife-proof fencing materials until all liquids are evaporated. The solid contents remaining in each of the reserve pits, typically consisting of nonhazardous, nontoxic drilling mud and rock cuttings, would be tested after all liquids have evaporated for pH, metals, and total petroleum hydrocarbon or oil and grease concentrations to confirm that they are not hazardous. If the test results indicate that these solids are nonhazardous, the solids would then be dried, mixed with the excavated rock and soil, and buried by backfilling the reserve pit. If any hazardous materials were identified, they would be removed and properly disposed off-site in accordance with all applicable local, state, and federal laws.

Wells determined to have no commercial potential and not needed for monitoring would eventually be plugged and abandoned in conformance with the well abandonment requirements of the BLM and NDOM. Abandonment typically involves filling the well bore with clean, heavy abandonment mud and cement until the top of the cement is at ground level. This ensures that geothermal fluids would not move into the well column and then out into non-geothermal aquifers. The well head and any other equipment would then be removed, the casing cut off well below ground surface, and the hole backfilled to the surface.

Following abandonment of a well, access roads and well pads would be reclaimed. Each well pad and constructed road would be disked and graded, if necessary, to de-compact the soil, turn under any applied gravel, and restore grade, if necessary. Stockpiled and seeded topsoil, if any, would be placed back over the disturbed areas. Disturbed areas would be reseeded with a BLM-approved, weed-free seed mix.

Production Wells

Production and Injection Wells

Production wells produce geothermal fluid that is pumped through pipelines to the power plant(s). Injection wells are used to return the geothermal fluid from the power plant(s) to the geothermal reservoir. Injection ensures the longevity and renewability of the geothermal resource. Unlike slim wells that are drilled using a hollow drill bit to test the geothermal resource, production and injection wells are full-size wells drilled to a wider diameter, allowing for either production or injection use, depending on observed well characteristics.

ORNI 32 is proposing up to 18 production and injection well pads, all located within the AOI on BLM-administered or Navy lands (**Figure 3**). The number of geothermal production and injection wells required for the project principally depends on the observed productivity (or injectivity) of the wells and the temperature and pressure of the produced geothermal fluid; therefore, it is not known at this time the precise number and location of production and injection wells that would be required. Since as many as three wells could be drilled on each of the 18 well pads, more than 18 full-size production or injection wells would be possible.

The proposed production and injection well sites and selected attributes are listed in **Table 5**, Proposed Wells. The coordinates provided in this table are estimates of the actual location; wells may be sited in a slightly different location, but they would remain within the same Kettleman number[11] as shown in the table.

Production or injection wells may be drilled on the same well pads used for slim hole resource testing wells. To allow development flexibility, more proposed well pads are proposed and shown in **Figure 3** than would likely be drilled. Any full-size wells drilled at well pad locations shown in **Figure 3** would be assigned production or injection status, as productivity or injectivity of the wells is observed during exploration.

Geothermal Well Drilling Program

ORNI 32 would submit a detailed geothermal drilling program to the BLM and, if appropriate, to the Navy for review and approval prior to beginning drilling operations. If necessary, the BLM may include additional provisions or conditions needed to address environmental concerns or other site-specific issues with the geothermal drilling permit.

Production/Injection Well Pad Layout and Design

Each production and injection well pad would cover an area approximately 350 feet by 375 feet, or approximately 3 acres. Drill pad preparation activities would include clearing, earthwork, drainage and other improvements necessary for efficient and safe operation, and for fire prevention.

Drill sites would be prepared to create a level pad for the drill rig and a graded surface for the support equipment. Fenced reserve pits, or sumps, would be constructed as described in **Section 2.1.2**, under Site Preparation.

ORNI 32 would obtain a construction stormwater permit from the NDEP, which includes a stormwater pollution prevention plan. In compliance with the Construction Stormwater Permit, stormwater runoff from undisturbed areas around the constructed drill pads would be directed into ditches surrounding the drill pad and back onto undisturbed ground consistent with BMPs. In addition, the site would be graded to prevent stormwater runoff from the pad.

[11] A system for numbering geothermal wells as described in the BLM's Geothermal Drilling Permit form (BLM 2019b).

Table 5
Proposed Wells

Kettleman Well Number	UTM Coordinates[1] Easting	UTM Coordinates[1] Northing	Well Type[2]
Lamb Mineral Interests			
52-19	406702	4402543	Deep core hole/full-size well
Lease Number N-60686 T22N; R35E			
83-18	407420	4403693	Deep core hole/full-size well
24-17	407705	4403526	Deep core hole/full-size well
75-18	407147	4403323	Deep core hole/full-size well
Lease Number N-83934 T22N; R35E			
28-8	407917	4404359	Deep core hole/full-size well
36-8	407966	4404738	Deep core hole/full-size well
Lease Number N-92479 T22N; R35E			
43-8	408226	4405326	Deep core hole/full-size well
41-8	408196	4405642	Deep core hole/full-size well
32-8	408003	4405533	Deep core hole/full-size well
34-8	408034	4405058	Deep core hole/full-size well
33-8	407981	4405302	Deep core hole/full-size well
13-8	407584	4405232	Deep core hole/full-size well
16-8	407538	4404672	Deep core hole/full-size well
48-7	406589	4404328	Deep core hole/full-size well
15-8	407678	4404853	Deep core hole/full-size well
72-18	407164	4403909	Deep core hole/full-size well
52-18	406677	4403931	Deep core hole/full-size well
Lease Number N-92717 T22N; R35E			
64-18	406869	4403491	Deep core hole/full-size well

Source: Ormat GIS 2016

[1] Coordinates are in North American Datum of 1983 UTM 11N (meters)
[2] Well types are as follows:

- Core holes are wells that are drilled using a hollow drill bit; whole rock samples (cores) can be extracted from wells drilled this way.
- Slim hole wells are typically less than 6 inches in diameter; they are used to measure geothermal gradients and pursue flow tests to assess the geothermal resource. Slim hole wells can be expanded later into full-size production wells.
- Deep core holes are cores drilled to a relatively greater depth.
- Full-size wells are drilled to a wider diameter than slim hole wells or core holes, allowing for either production or injection use, depending on observed well characteristics.
- Slim hole wells and/or full-size wells could be drilled on each pad.
- Monitoring wells are wells used for monitoring various characteristics of water resources.

Each well would be drilled with a large rotary drill rig. 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, including trailers, compressors, drill pipe, mud systems, and other large equipment, would be brought to the prepared 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. During drilling, ORNI 32 would maintain adequate obstruction lighting on any construction equipment or drilling rigs that project above 40 feet. ORNI 32 would notify Naval Air Station (NAS) Fallon before setting up the drill rig. This is to ensure that lighting is compatible with the Navy's Night Vision Device aircraft operations and to avoid potential conflicts with low-flying aircraft.

Reserve pits would be constructed in accordance with BMPs identified in the BLM Gold Book (BLM 2007a) and NDOW's Geothermal Sump Guidelines (NDOW, no date) on each pad for the containment and temporary storage of water, drill cuttings, and waste drilling mud during drilling operations. The reserve pit for test wells would measure approximately 75 feet by 250 feet by as many as 10 feet deep. Reserve pits would be used until the associated wells are plugged and abandoned.

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 could be as high as 18. Drilling at each full-size well would be expected to last approximately 1 to 2 months on average.

Water required for well drilling could range up to 75 gallons per minute (gpm). Water necessary for these activities would likely be obtained from offsite sources, potentially including private wells in the Dixie Valley, and trucked to the site.

Following construction, an approximately 15-foot by 15-foot by 10-foot-high motor control building would be located on the well pad within approximately 50 feet of each production well to house and protect the auxiliary well control systems, motor switch gear controls and sensors, transmitters, and geothermal fluid treatment systems. The well control systems, data transmitters, and geothermal fluid treatment systems used for the injection wells would be placed inside a smaller structure located on the injection well pads.

Well Drilling

The wells would each be drilled and cased to a design depth selected by the project geologist. Blowout prevention equipment, which is typically inspected and approved by the BLM and NDOM, would be utilized while drilling below the surface casing. During drilling operations, cool water, salt, or barite would be stored at each well site for use in preventing uncontrolled well flow (killing the well), as necessary.

The well bore would be drilled using nontoxic, temperature-stable drilling mud composed of a bentonite-water or polymer-water mix for all wells. Variable concentrations of approved drilling additives would be added as needed to prevent corrosion, increase mud weight, and prevent mud loss. Additional drilling mud would be mixed and added to the mud system as needed to maintain the required quantities. Fenced reserve pits on each pad would contain water, drill cuttings, and waste drilling mud during drilling operations.

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. Additionally, each well may need to be worked over or redrilled if mechanical or other problems are encountered while drilling or setting casing that 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 stimulation of the formation using dilute acid or rock fracturing techniques. Well redrilling may consist of reentering and redrilling the existing well bore; reentering the existing well bore 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 bore through a new conductor casing.

Flow Testing

Following well construction, and while the drill rig is still over the well, the residual drilling mud and cuttings would be flowed from the well bore and discharged to the reserve pit. This may be followed by one or more short-term flow tests. Each test would consist of flowing fluid from the well while monitoring geothermal fluid temperatures, pressures, flow rates, chemistry, and other parameters. An "injectivity" test may also be conducted by injecting the produced geothermal fluid 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.

Long-term flow tests (14 to 28 days, or more) of each well drilled could be conducted following the short-term flow tests to more accurately determine long-term well and geothermal reservoir productivity. Two or more wells could be used during these tests.

Emergency Contingency Plans

Existing drilling operation emergency contingency plans, including a fire contingency plan, a spill or discharge contingency plan, and a hydrogen sulfide contingency plan (see **Appendix J**), would all be implemented to mitigate health risks and increase overall safety for the project. Additionally, ORNI 32 would collaborate with local public services, including fire, police, and ambulance, throughout the duration of the project.

Monitoring Wells

Numerous groundwater monitoring wells are proposed. Locations of monitoring wells MW-1 through MW-5 are shown in **Figure 3**; Figure 17 in the ARMMP (**Appendix H**) depicts all proposed groundwater monitoring sites. Additional monitoring wells in the monitoring locations may be added as additional phases of geothermal power plant development progress. Groundwater wells are proposed to be monitored for chemistry, field parameters, and hydraulic head; geothermal reservoir wells are proposed to be monitored for temperature, pressure, and water chemistry. Additional information regarding the proposed groundwater and geothermal reservoir monitoring locations and protocols is in Section 3.2 of the ARMMP (**Appendix H**).

2.1.3 Power Plants and Ancillary Facilities

The Proposed Action includes construction and operation of up to two approximately 30 MW net rated geothermal power plants. The proposed power plants would be located on approximately 16 acres each (up to 32 acres total) in two candidate locations; the final locations would be dependent upon site-specific engineering considerations. Construction of the second power plant would be dependent upon the productivity of the first plant and the results of aquatic resources monitoring (see **Appendix H**). The potential locations shown in **Figure 3** and other figures in this EA are shown to display the scale of each power plant site and the range of candidate plant locations. At either location, an approximately 0.7-acre substation, used to transform generated low-voltage electrical energy to the higher voltage required for a transmission line, would be constructed within the power plant boundary.

The most prominent features of the power plant, both in height and mass, would be the air-cooled condensers. They range up to 35 feet in height and are about two thirds the length of the site. The balance of the plant would be an array of pipes, the turbine/generator, and a small building to house electrical equipment. A gated, chain link fence would be installed around the perimeter of each facility in order to prevent unwarranted access to the facility/electrical generation areas by the public and/or wildlife.

All buildings housing the offices, electrical room, control room and auxiliary buildings would be rigid, steel-frame, pre-engineered structures with steel panel walls and a steel roof. The exterior of the buildings would be painted consistent with the BLM's visual color guidelines to blend in with the surrounding area.

A microwave communication tower and antenna would be constructed within each power plant site to deliver signals from control centers and other remote locations, and to report operating status. This network also would provide voice communication from dispatchers to power plant operators and maintenance personnel. The top of the tower would be approximately 75 feet above ground surface. The tower would be painted a BLM-approved color to blend in with the landscape. The tower would provide a microwave communications link from the power plant sites to existing communications sites within the region. The microwave link would be in the Federal Communications Commission licensed 6 gigahertz range with actual frequencies determined during the microwave path analysis and Federal Communications Commission frequency coordination. ORNI 32 is coordinating with the Navy to identify appropriate microwave frequencies and technologies to avoid any interference issues.

An existing mineral material sale contract (NVN-92900) is in the lease area (see **Figure 3**). The proposed plants would be located to not conflict with the mineral material sale contract.

Power Plant Construction

Project construction could require up to 50 workers, although fewer would be on-site most of the time during construction. This is because construction activities would be staged. Construction of the power plants and well field facilities would take approximately 12 to 24 months to complete once all permits are obtained and equipment orders are scheduled. It is anticipated that most construction workers would reside in the Fallon, Nevada area.

Upon BLM approval, initial site preparation would commence with grubbing and clearing of the utilization area. Following grubbing and clearing, topsoil would be removed and stockpiled for later use in revegetation and reclamation. Stockpiled topsoil would be seeded with a BLM-approved, weed-free seed mix to ultimately increase the potential for reclamation success. Since the topography of all site options is relatively flat, it is anticipated that minimal cutting of slopes would be required. If material generated from cutting slopes does not provide the required amount of fill material, fill could be obtained from the BLM gravel pit described in **Section 2.1.2**.

Any fill slopes constructed would be 2:1 or flatter as necessary and would be compacted and maintained to minimize erosion and provide slope stability. The proposed power plant equipment and structures would be situated on conventional spread footings, except the area beneath the turbine and generator, which may require additional support from pilings. Further geotechnical studies would determine what type of foundation may be required beneath these units.

During construction, a portion of the power plant sites and adjacent well pads would be devoted to equipment and materials laydown, storage, construction equipment parking, small fabrication areas, office trailers and parking. Equipment and materials laydown space is required for large turbine parts, structural steel, piping spools, electrical components, switchyard apparatus, and building parts.

Most access roads would be constructed during the exploration activities. The power plants and associated structures would be situated, if possible, along these access roads, which would limit new access road construction. All access roads, laydown areas, and parking areas would be provided with a gravel surface after grading, which would inhibit sediment runoff from the surface.

Ancillary facilities and power plant components that would be constructed on the power plant pads include offices, restrooms, the electrical room and control room; maintenance building; condensing fan equipment; geothermal fluids containment basin; electrical substation; and other smaller, ancillary structures.

Temporary utilities would be provided for the construction offices, the laydown area, and the power plant sites. Temporary construction energy would be supplied by a temporary generator and, if available when the transmission line is completed, at the site by utility-furnished power. Area lighting, drinking water, and portable toilets and sanitation would be installed. Use of nighttime lighting during construction would be minimized to the extent possible to comply with Dark Sky Initiative lighting practices and to reduce impacts on the Navy's Night Vision Device aircraft operations. During construction, ORNI 32 would maintain adequate aircraft navigation safety lighting to any construction equipment that is more than 40 feet tall.

Power Plant Operation

The power plants would use a binary design with an air-cooled heat rejection system. The geothermal fluids for the binary power plants would be pumped from the production wells. Once delivered to each power plant, the heat in the geothermal fluid would be transferred to the binary (i.e., secondary) fluid in multiple-stage, noncontact heat exchangers. The binary turbine units would use n-butane (butane), a flammable but nontoxic hydrocarbon, as the binary fluid, which would circulate in a closed loop. The heat from the geothermal fluid would vaporize the butane, which would turn the binary turbine and generator to make electricity. Butane totals for the system cannot be determined until engineering is complete. For context, Ormat's Tungsten Mountain geothermal plant, a 27 MW rated air-cooled binary design plant, contains 603,000 pounds of pentane (the binary fluid used in that plant) in the system at any given time. Each of the proposed plants would likely contain similar amounts of binary fluid.

The vaporized butane would exit the turbine and condense back into a liquid in a shell-and-tube, noncontact, air-cooled condenser. The condensed butane would then be pumped back to the heat exchangers for reheating and vaporization, completing the closed cycle. The residual geothermal fluid from the heat exchangers would be pumped under pressure to the geothermal injection wells through the injection pipelines and then injected back into the geothermal reservoir. Before being reinjected, the water would be air-cooled using condensers which would minimize the loss of water.

There would be no emissions of butane to the atmosphere during normal plant operation. Some butane emissions would occur due to the escape from rotating seals and flanges on the heat exchangers and during maintenance on the binary power plant units. Butane emissions are estimated to average 12 tons per year per plant, which would be regulated through a permit issued by the NDEP BAPC.

After exiting the heat exchangers, the cooled geothermal fluid would be pumped to the geothermal injection wells through the injection pipelines, and injected back into the geothermal reservoir.

Based upon data from other Ormat facilities, the total geothermal fluid production rate for each Dixie Meadows facility would be up to about 6.4 million pounds per hour per plant (14,000 gpm per plant) at an average temperature of 300 degrees Fahrenheit (°F). Production well flow rates are expected to range from approximately 2,000 to 3,000 gpm per well, based on five or six production wells. The total estimated geothermal production rate could increase or decrease. This would depend on the number of production wells that are installed and the observed geothermal fluid temperature and production rate at each well.

All the geothermal fluid brought to the power plants would be injected back into the geothermal reservoir. The injection pressure, and the volume injected per well, would depend on the permeability of each well's injection zone. The total estimated injection rate into the injection wells would be similar to the production rate, but slightly lower volume due to fluid contraction due to cooler temperatures (typical minimum temperature of 150° to 170°F). Injection rates would depend on the final number of injection wells installed, as well as the permeability of each well's injection zone.

Lighting used during operation of the power plant(s) and all ancillary facilities would be minimized; the motion would be controlled to the extent possible, and lighting would be downward facing to minimize impacts on the Navy's Night Vision Device aircraft operations.

Substation Construction

Each power plant would include an electrical substation at which electrical power generated at 12.47 kV would pass through a transformer to increase the voltage to 120 kV. Each substation would include a 12.47 kV circuit breaker to protect the electric generators, potential and current transformers for metering and system protection, and a circuit breaker to protect the substation. A main control building would contain instrumentation and telecommunications equipment.

The substations would measure up to 200 feet by 150 feet each and would be surrounded by an 8-foot-tall chain-link fence with vehicle and personnel access gates. The surface of the substations would be covered by gravel, and the substation equipment would be placed onto concrete foundations.

Work at the substation sites would begin by clearing existing vegetation and grading a level pad for installation of the substation. Once the pad is prepared, the site would be secured with chain-link fencing. Once the equipment is installed, pit run gravel would be spread over the site to a depth of approximately 4 inches. Gravel for each plant's transformer site would be obtained through Ormat's existing mineral material sales contract with the BLM, as described in **Section 2.1.2**, under Site Preparation.

Substation construction is anticipated to mirror the power plants' construction timelines. Construction would commence only after all required permits and authorizations have been secured.

Substation Operation

Once the substation and associated facilities are operational and in-service, operations and maintenance personnel would maintain the proposed transmission system by monitoring, testing, and repairing equipment.

Site Decommission

At the end of project operations, which is expected to be at least 30 years from the start of operations, all aboveground facilities and areas of surface disturbance associated with geothermal development would be removed and reclaimed. Ultimately, ORNI 32 would implement a site reclamation plan in conformance with reclamation standards outlined in Appendix D, Best Management Practices and Mitigation Measures, of the BLM's 2008 geothermal leasing PEIS (see **Appendix F**). ORNI 32 would develop a reclamation plan prior to construction. The plan would address restoring the surface grades, surface drainage, and revegetation of cleared areas. Stormwater diversion would remain in place until successful revegetation is attained.

2.1.4 Pipelines, Access Roads, and Support Facilities

Geothermal Fluid Pipelines

Pipelines would bring the geothermal fluid from the production wells to the power plants and deliver the cooled geothermal fluid from the power plants to the injection wells. Pipeline routes generally follow the shortest distance from each well pad to the next well pad or the power plants. This is done to minimize the amount of pipe required, reduce heat losses and the energy required to move the fluids, and minimize the amount of ground disturbance. In addition, the proposed pipeline routes generally follow existing or proposed roads to facilitate ongoing monitoring and future maintenance. However, the final alignment of the pipeline routes would be dictated by the specific wells completed for the project and the need to match fluid characteristics and balance fluid volumes in these pipelines.

Pipeline Construction

The construction of the aboveground pipelines would require grading of the pipeline corridor. Pipeline construction would begin with auguring holes for pipe supports, which would be pre-fabricated off-site and set into concrete. While the concrete is curing, the approximately 40-foot long steel pipe sections would be delivered and placed along the construction corridor. A small crane would lift the pipe sections onto the pipe supports and temporary pipe jacks so that they could be welded together into a solid pipeline. Once welded and the welds tested, the pipe would be jacketed with insulation and an aluminum sheath (appropriately colored, as determined by the BLM, to blend with the area).

At access road crossings, the pipeline would be buried in a trench using a pipe sleeve. Horizontal or vertical loops to allow thermal expansion would be constructed either outside the plant area (between the plant and the wells for horizontal loops), or within the plant area (vertical loops). When completed, the top of the new geothermal pipelines would average 3 feet (and up to 6 feet) above the ground surface. Electrical power and instrumentation cables for the wells would then either be installed in steel conduit constructed along the same pipe sleepers (i.e., supports) or hung by cable from pipe along the pipeline route.

Water Requirements

During construction of the power plant(s) and pipelines, ORNI 32 would need water for dust control, soil compaction, and miscellaneous uses. An estimated total of 17.6 acre-feet would be used throughout a 1-year construction period.

Water required for construction would likely be obtained from a private well, pending landowner approval. This water would be trucked to the construction site.

Following construction, facility water needs would include water for the fire pump system, general maintenance water, and water for the domestic water system, and would be approximately 2.5 to 3.0 acre-feet/year throughout the life of the project. This water would be trucked to the project area as described above. Drinking water for on-site personnel would be provided from bottled water. Portable toilets would be provided throughout the site.

Operation of the air-cooled geothermal plants is not anticipated to consume geothermal water resources. This is because all geothermal fluid used in production would be reinjected into the geothermal reservoir; therefore, augmenting the geothermal reservoir by injecting basin-fill water (Benoit et al. 2000) or other water is not anticipated to be necessary.

Water required for decommissioning of the project, including earthwork and reclamation, is estimated to be 13.6 acre-feet. This water would be obtained from the same source(s) as construction water, and trucked to the project sites where needed.

Site Access and Road Construction

Primary site access is by driving about 40 miles east from Fallon on US Highway 50 and then north on State Highway 121 (Dixie Valley Road) for approximately 36 miles.

The number of miles of new access roads constructed would depend on well pad configuration, but total surface disturbance would not exceed 40 acres.

Road beds would be constructed using a dozer and/or road grader. An average of 6 inches of gravel would be put on the road beds. Gravel would be obtained from an existing gravel site (see **Figure 3**).

Constructed access roads crossing existing drainages may require installation of culverts. Culvert installation would follow BLM design criteria and would be constructed pursuant to standards established in the BLM Gold Book (BLM 2007a).

Surface Reclamation

As described in **Appendix J** (see **Section J.1.4**), a reclamation plan for interim and final reclamation procedures for the project would be developed and implemented after BLM approval. Under the reclamation plan, once drilling is complete, the portion of the pad not needed for ongoing operations, potential work, or re-drilling of the well would be reclaimed. The reclaimed portions would be recontoured to a final or intermediate contour that would blend with the surrounding topography as much as possible. Areas to be reclaimed would be ripped, tilled, or disked on contour to relieve compaction, covered with stockpiled topsoil, and seeded with a BLM-approved, weed-free seed mix.

At the end of project operations, the wells would be plugged and abandoned in compliance with BLM and NDOM regulations. Abandonment typically involves filling the well bore with heavy abandonment mud and cement until the top of the cement is at ground level, which is designed to ensure that fluids would not move across geologic barriers into different aquifers. The well head and any other equipment would then be removed, the casing cut off below the ground surface, and the hole backfilled to the surface.

Pipeline reclamation would include pipeline removal and cutting off support posts flush with the ground surface.

Access road interim reclamation would consist of reclaiming portions of the road not needed for vehicle travel. The site is relatively flat, but if present, cut slopes, fill slopes, and borrow ditches may be reseeded to restore habitat, forage, and scenic resources, and to reduce soil erosion and maintenance costs. Final reclamation would include recontouring the road back to the original contour, seeding, and controlling noxious weeds, and may also include other techniques to improve reclamation success such as ripping, scarifying, replacing topsoil, constructing waterbars, mulching, redistributing woody debris, and barricading.

2.1.5 Gen-Tie

This alternative includes the construction and operation of an overhead 120 kV gen-tie and associated facilities that would be routed northeasterly to Ormat's Jersey Valley power plant. The proposed gen-tie and associated facilities are summarized below; they are fully described in the Plan of Development (ORNI 32 2020) included in **Appendix I**.

Route Description

The 120 kV gen-tie would extend about 48 miles in a northeasterly direction from the proposed Dixie Meadows geothermal power plant(s) to Ormat's existing Jersey Valley Geothermal Power Plant (see **Figure 3**).

In the 2017 draft EA Proposed Action, ORNI 32 proposed to construct approximately 6,200 linear feet of the northern gen-tie alignment across an area containing a series of springs and associated wetlands and riparian vegetation in T22N, R35E, Sections 4, 5, and 8 in the northern portion of the Dixie Meadows. The BLM received numerous public comments (**Appendix G**) describing the potential effects of this alignment and requesting that the gen-tie be realigned. In response, the Proposed Action now reflects a realigned portion of the gen-tie that formerly crossed wetlands and riparian areas in Dixie Meadows. To the extent possible, the proposed gen-tie would be constructed on currently disturbed land[12] adjacent to the existing Dixie Valley Road, outside of wetlands and riparian areas. The alignment analyzed in the 2017 public draft EA is no longer a consideration for the Proposed Action.

A separate geothermal power plant, known as the Dixie Valley (Terra-Gen) Power Plant, is present about 16 miles north of the Dixie Meadows project area. An existing 230 kV power transmission line extends to the south from that power plant and through the Dixie Meadows project area. This transmission line cannot be used by the Dixie Meadows project. This is because there may not be adequate capacity for the proposed Dixie Meadows project, and the line's owner is reserving any available capacity for their own future use; therefore, a separate transmission line is required. The Dixie Meadows transmission line would be installed parallel to, and east of, the Terra-Gen transmission line up to their plant site. The distance between the two power lines would range from 90 feet (near the Dixie Meadows site) to 250 feet (closer to the Terra-Gen plant).

Just south of the Terra-Gen Power Plant, the Dixie Meadows line would completely diverge from the Terra-Gen line and continue another 31 miles in an east or northeasterly direction until it reaches the Jersey Valley geothermal power plant. This segment would largely parallel existing gravel roads.

From the Jersey Valley facility, power would be transmitted along the existing Jersey Valley power line to the NV Energy regional power line located at Bannock.

Depending on the exact location of the proposed Dixie Meadows power plant(s), the entire gen-tie route would be located on BLM-administered land and a portion of Navy lands. No private property would be affected.

[12] Area that is barren or has relatively low vegetation cover that is associated with some form of generic human alteration or management regime (USGS 2005).

Components

The gen-tie would consist of a single 120 kV circuit using 397.5 MCM[13] aluminum conductor steel-reinforced (ACSR) "Ibis" and optical ground wire. Overhead conductors would be non-specular to reduce sunlight reflection and minimize impacts on visual resources. The gen-tie would use direct-burial, self-supporting wooden monopole structures. Structure heights would be 55 to 70 feet with a span between 300 and 450 feet, depending on the terrain. Poles would include tangent, angle and dead-end types. The diameter at the base of the structure would range from 2 to 3 feet. Structure sites would include assembly and crane-landing areas.

Each structure would carry a single overhead ground wire/fiber-optic cable for lightning protection and fiber-optic communications. The overhead ground wire measures approximately 0.75 inches in diameter and is constructed of concentric layers of galvanized steel wires surrounding a hollow core, which contains 12 to 48 fiber-optic strands (depending on final requirements). Metering and communications equipment would be present at each generator site. Due to the potential for electrocution, collision, and nesting or perching by migratory birds on overhead power lines, the Avian Power Line Interaction Committee (APLIC) guidelines (2006 and 2012) would be implemented to reduce this risk through facility design.

ROW Width Requirements

The gen-tie would require a 90-foot-wide ROW during operation. An additional 210-foot-wide short-term ROW, for a total ROW width of 300 feet, would be required to accommodate construction activities.

Construction, Operation, and Decommissioning

A crew of up to seven workers would begin working at the site approximately 1 to 2 weeks prior to the start of construction. During this time, they would transport equipment and construction materials to the project site laydown area. There are three potential locations for the laydown area used for temporary storage of equipment needed to construct the gen-tie: the power plants site(s), existing well pads, or an unused Jersey Valley well pad. The laydown area would not be in wetlands or riparian areas. Construction water would be obtained from geothermal fluid, from a facility water supply well (if installed as described in **Section 2.1.4**), or from other private or Navy-owned wells.

The initial activity prior to construction would be the engineering survey and staking of project facilities. This would include marking structure locations, anchor sites, staging and material yards, wire setup sites, and the substation. The site would be staked, and preconstruction plant and wildlife surveys would occur to delineate any sensitive resource areas.

[13] A measurement of wire gauge. A 400 MCM wire is approximately 0.85 inches in diameter.

Existing roads would be utilized whenever possible to access the ROW. In areas where no reasonable access roads exist, ORNI 32 would utilize overland travel to access the ROW.

In order to establish work areas where poles and conductors would be installed, vegetation clearing and minimal grading within the ROW could be necessary. Vegetation removal would be minimized to the extent possible.

In order to stage equipment and conduct work, the structure work areas and stringing sites would require a relatively flat surface. Therefore, the areas could be graded, and gravel or soil could be imported to achieve the necessary elevation. Any gravel would be obtained from a gravel site (see **Figure 3**) through a mineral material sales contract with the BLM, as described in **Section 2.1.2**, under Site Preparation.

At each structure site, work areas would be required to facilitate the safe operation of equipment and construction operations. Construction laydown areas would be located in previously disturbed areas whenever possible (i.e., along access roads or on well pads) and would not be in wetland or riparian areas. At each location, a work area would be cleared and leveled, if necessary. In relatively flat terrain, this would not be needed. Structure pieces would be delivered to the laydown area where workers would assemble the pole and attach insulators and hardware. The pole would be erected using a crane from the staging area. After construction, the laydown area would be reclaimed and restored with the exception of a 20-foot by 30-foot pad on both sides of the gen-tie, which would be used for future maintenance of the structure as necessary.

Work areas would be cleared of vegetation only to the extent necessary. Access would be via overland travel, and structures would be assembled in relatively level areas without the need for blading. After construction, all work areas not needed for ongoing operation and maintenance needs would be recontoured to match the surrounding terrain, de-compacted, and seeded. BLM-approved, weed-free seed mixes would be applied to these areas. Work areas would not be in riparian or wetland areas.

Temporary material storage yards would be required for construction materials. These staging areas would be located at existing well pads, or within the power plants site(s), and would serve as reporting locations for workers, parking spaces for vehicles, and storage spaces for equipment and materials. Structural materials such as structure steel, hardware, foundation material, spools of conductor, and shield wire, would be hauled by truck into the yard. A crane or forklift would be required to unload and transport the materials. Construction materials would be delivered by truck from the yard to the lay down areas. From these areas, materials would be brought to structure sites as needed. Crews would load the material required for the workday, thus limiting the weight hauled on the access roads. This would limit the impact and rutting on access roads caused by heavy vehicles.

Materials, such as gen-tie poles, insulators, hardware, and guy wire anchors, would be delivered from the laydown area to each gen-tie structure site. Assembly crews would attach insulators, travelers, and hardware to form a complete structural unit. The wooden monopole structures would require a temporary workspace of up to 300 feet by 300 feet and a 30-foot by 40-foot area for line construction equipment. Erection crews would use a large, truck-mounted mobile crane to place the structures directly into the ground, depending on the soil conditions and results of geotechnical surveys. The poles directly embedded in the ground would be set in holes that are approximately 3 feet wide and 10 feet deep. These holes would be backfilled with native or imported materials. Guy wires to support the angle poles would be used to keep the structures vertical. As a safety precaution, guy wires would be made more visible if they cross over designated access roads. Signs, flagging, or other markings would be used to indicate the presence of guy wires. Upon construction completion, disturbed portions of the 210-foot-wide short-term ROW would be revegetated with a BLM-approved, weed-free seed mix.

Conductor and shield wire would be delivered on reels by flatbed truck to the various conductor pulling sites along the ROW. Other equipment required to install the conductor would include reel stringing trailers, tensioning machines, pullers, and several trucks including a bucket truck.

The conventional method for installing conductor and shield wire is to pull out a sock line or "pullrope" along the route of the line and manually lift the rope into stringing sheaves. The rope is brought to a puller at one end and a tensioner on the other end. The tensioner holds the wire reels and maintains enough tension to keep the wire off the ground and vegetation while the puller pulls the wire through the stringing sleeves. This method may require some overland travel between structures. When overland travel is required for this purpose, an all-terrain vehicle or similar type vehicle would be used.

Temporary guard structures would be installed to ensure that the conductors do not drop into the road or other locations that could result in a safety hazard. Splicing would occur between conductor spools. After the conductors are pulled in, conductor tension would be adjusted to properly sag the conductors. The conductors would then be clipped to the insulators and the stringing roller wheels removed.

Sites for tensioning equipment and pulling equipment are typically approximately 300 feet by 300 feet in size. Typically, conductor pulling sites for stringing the conductor would be spaced at 15,000 to 20,000 foot intervals. However, distances between each site would vary depending on the geography, topography, and environmental sensitivity of the specific area; the length of the conductor pull; and, equipment accessibility. Pulling sites would require a temporary working area. At each pulling site, stringing equipment would be set up approximately 250 feet from the initial structure for leveraging the conductor pull safely. At angle structure pulling sites, the stringing equipment must also be 250 feet from the poles, or up to 100 feet outside of the 300-foot temporary ROW boundary (assuming the power line is centered within the ROW). However, the stringing equipment would be present within the 500-foot-wide zone centered on the ROW alignment that has been surveyed for biological and cultural resources. These sites would not be in riparian or wetland areas.

Emergency maintenance, such as repairing downed wires during storms and correcting unexpected outages, would be performed by ORNI 32 or licensed maintenance contractors.

Waste materials and debris from construction areas would be collected, hauled away, and disposed of at approved landfill sites. A covered portable dumpster would be kept on-site to contain trash.

After construction is complete, all existing roads would be left in a condition equal to or better than their preconstruction condition, as directed by the BLM, as applicable. Additionally, all other areas disturbed by construction activities would be recontoured to match the surrounding terrain, de-compacted, and seeded. BLM-approved, weed-free seed mixes would be applied to these disturbed areas. Cleared vegetation would be shredded and distributed over the ROW as mulch and erosion control, or disposed of off-site depending on agency agreements. ORNI 32 vehicle access to seeded areas would be restricted until achievement of reclamation success criteria.

Restoration and Reclamation

As described in **Appendix J** (see **Section J.1.4**), a reclamation plan for interim and final reclamation procedures for the project would be developed and implemented after BLM approval. The electrical equipment and monopoles are anticipated to have a lifetime of approximately 50 to 60 years or more depending upon maintenance operations and climatic conditions. During restoration and reclamation, poles, conductors, and hardware associated with the gen-tie would be removed. The remaining holes would be filled with soil gathered from the immediate vicinity. The areas where the poles were removed would be raked to match the surrounding topography. Bladed areas would be recontoured and seeded with a BLM-approved, weed-free seed mix.

2.1.6 Environmental Protection Measures

All construction, operation, and maintenance activities associated with the project would be conducted in compliance with all relevant federal, state, and local regulations and permits and would also be conducted in accordance with the requirements and conditions specified in the lease stipulations (see **Appendix A**). Activities would also be conducted in accordance with the requirements and conditions specified in the NEPA decision record and BLM ROW grant for the gen-tie.

In addition to these requirements, ORNI 32 has committed to implementing EPMs to further avoid or minimize potential adverse environmental impacts. EPMs are described in detail in **Section J.1** of **Appendix J** in this EA. In summary, these measures would allow ORNI 32 to prevent or control fire, prevent soil erosion and noxious weed establishment and spread, protect surface and groundwater, protect wildlife, protect cultural properties and visual resources, minimize air and noise pollution, and minimize hazards to public health.

2.1.7 Geothermal Lease Stipulations

As discussed in **Section 1.5.1**, the PEIS and ROD for Geothermal Leasing in the Western United States (BLM 2008b, BLM 2008c) developed geothermal leasing stipulations that were applied to geothermal resource leases subsequently issued by the BLM. Stipulations are included in the federal geothermal leases issued to or acquired by ORNI 32 in the Dixie Valley Geothermal Unit Area. Full copies of these stipulations are provided in **Appendix A**. The stipulations are summarized in **Section J.3** in **Appendix J**.

2.2 Alternative 1 (Southern Gen-Tie Route)

Under Alternative 1, ORNI 32 would construct and operate the proposed project as described in **Section 2.1**, Proposed Action (Northern Gen-tie Route), with the exception that there would be a different gen-tie route and associated facilities.

2.2.1 Gen-tie Route Description

Under Alternative 1, the gen-tie would extend about 31 miles to the south from substations at the proposed Dixie Meadows geothermal power plant(s) to NV Energy's Fort Churchill to Gonder 230 kV transmission line (see **Figure 6**, Gen-Tie Route—Alternative 1). Throughout its length, the gen-tie would run parallel to the existing Oxbow power line. This existing transmission line cannot be used by the Dixie Meadows project because, per discussions with the line's operator, there may not be adequate capacity for the proposed Dixie Meadows project; therefore, a separate transmission line is required. To maintain adequate separation from Navy-operated low-altitude aircraft, gen-tie towers would not exceed 100 feet in height.

Approximately 26.7 miles of this line would be located within an area that has been segregated from all forms of appropriation under the public land laws, including the mining laws, mineral leasing laws, and geothermal leasing laws, subject to valid existing rights. The BLM has segregated this area in response to an application received from the Navy for a withdrawal expansion for military use of the Naval Air Station Fallon, Fallon Range Training Complex in Churchill County, Nevada. The segregation was in effect for a period of 2 years from September 2, 2016, and extended for a period of 4 years on August 31, 2018.

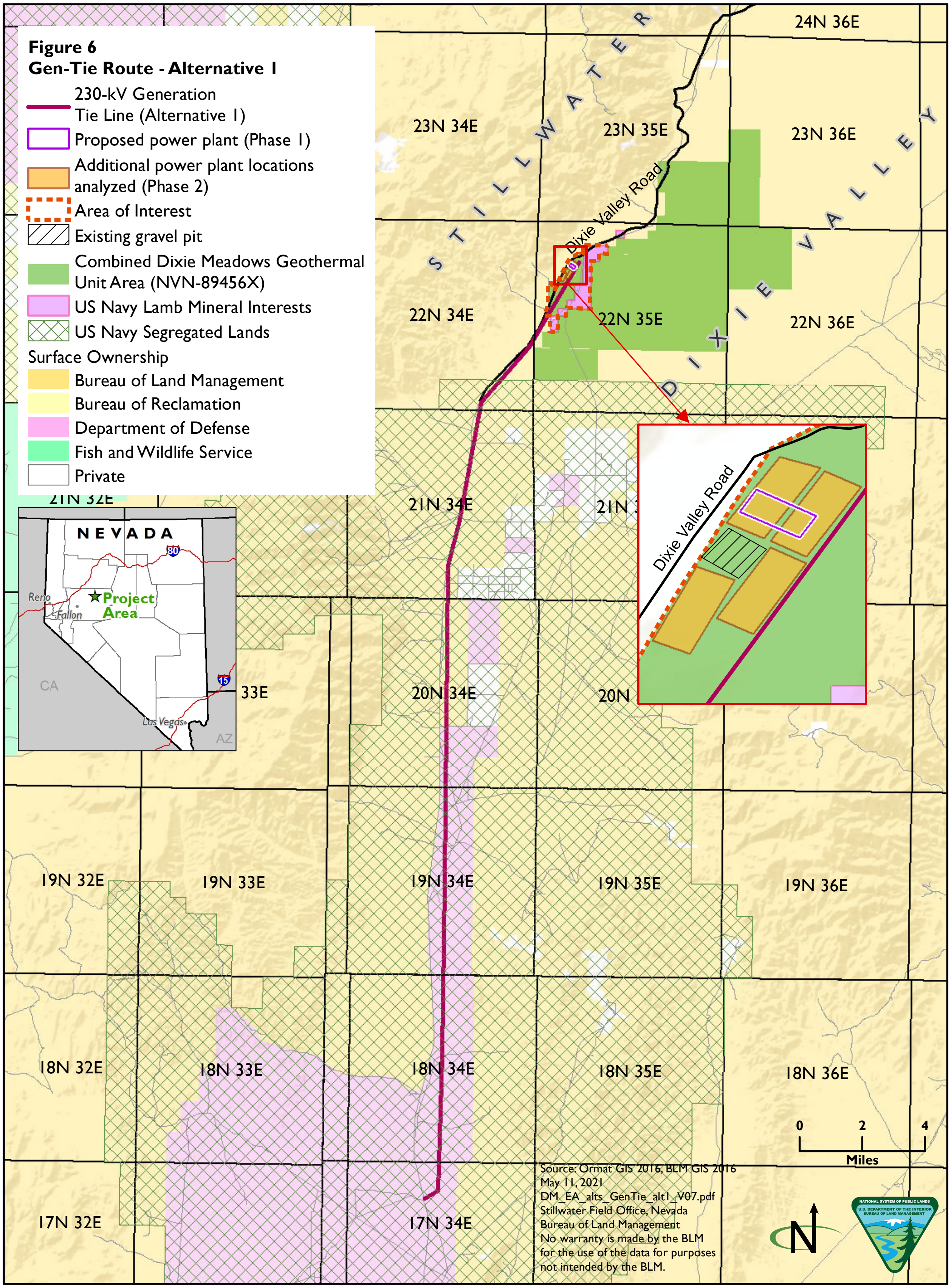

Figure 6
Gen-Tie Route - Alternative 1
230-kV Generation Tie Line (Alternative 1)
Proposed power plant (Phase 1)
Additional power plant locations analyzed (Phase 2)
Area of Interest
Existing gravel pit
Combined Dixie Meadows Geothermal Unit Area (NVN-89456X)
US Navy Lamb Mineral Interests
US Navy Segregated Lands
Surface Ownership
Bureau of Land Management
Bureau of Reclamation
Department of Defense
Fish and Wildlife Service
Private
NEVADA
Reno
Fallon
Project Area
CA
AZ
Las Vegas
STILLWATER
DIXIE VALLEY
Dixie Valley Road
24N 36E
23N 34E
23N 35E
23N 36E
22N 34E
22N 35E
22N 36E
21N 32E
21N 34E
33E
20N 34E
19N 32E
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Miles
Source: Ormat GIS 2016, BLM GIS 2016
May 11, 2021
DM_EA_alts_GenTie_alt1_V07.pdf
Stillwater Field Office, Nevada
Bureau of Land Management
No warranty is made by the BLM for the use of the data for purposes not intended by the BLM.
N

Two gen-tie alignments adjacent to the Oxbow line are possible. Both alignment options are located on BLM-administered land and Navy lands. No private property would be affected. For either alignment, a switching station would be required at the terminus site to connect the gen-tie to the NV Energy line. Depending on the gen-tie alignment, this substation would be located on Navy lands on either the west side or east side of the Dixie Valley Road. The amount of permanent ground disturbance associated with the switching station and access roads would be 8 to 10 acres in size.

The preferred gen-tie alignment option would run adjacent to the east side of the existing Oxbow line from the proposed Dixie Valley power plant(s) for about 11 miles and would then cross under the Oxbow line. For the remainder of its length, the alignment would follow the west side of the Oxbow line. The advantage of this route is easier access to its potential terminus switching station site, which would be on the west side of the Dixie Valley Road, north of the NV Energy line. The switching station site would have easy access along an existing gravel road.

The other alignment would run along the east side of the Oxbow Line for its entirety. No crossings of the Oxbow Line would be necessary except at the proposed Dixie Meadows power plant(s). The terminus switching station site of this east-side route would be located east of the Oxbow line, north of the NV Energy line. The site would be in a less-accessible area east of the Dixie Valley Road and the Dixie Valley Wash. This site has steeper slopes and a dry wash that bisects the site. A potentially expensive road with large culverts and/or a bridge crossing the Dixie Valley Wash would be required.

2.2.2 Components

The line voltage would be 230 kV, and a single transformer at the power plant(s) would be used to step voltage up to 230 kV.

Construction of the switching station site would begin by clearing existing vegetation and grading a level pad for installation of the substation. Once the pad is prepared, the site would be secured with chain-link fencing. Holes for the structure footings and underground utilities would then be excavated. The footings and underground utilities would be installed, including electrical conduits and additions to the ground grid, and the excavations would be backfilled. Aboveground structures and equipment would then be installed.

Once the equipment is installed, pit run gravel (2 inches wide or less) would be spread over the site to a depth of approximately 4 inches. Gravel would be obtained through a mineral material sales contract with the BLM.

2.2.3 ROW Width Requirements

ROW width requirements would be the same as described under the Proposed Action (**Section 2.1**).

2.2.4 Construction, Operation, and Decommissioning

Construction, operation, and decommissioning methods would be the same as described under the Proposed Action (**Section 2.1**). **Table 6**, below, summarizes the proposed new facilities with the estimated area of permanent and temporary disturbance for each facility.

2.2.5 Restoration and Reclamation

Restoration and reclamation would be the same as described under the Proposed Action.

2.2.6 Environmental Protection Measures

EPMs would be the same as those described for the Proposed Action. EPMs are described in detail in **Section J.1** in **Appendix J** of this EA.

Table 6
Area of Surface Disturbance (Alternative 1)

Disturbance Type	Amount of Disturbance (Approximate Acres)	Amount of Disturbance to Be Reclaimed (Approximate Acres)	Amount of Disturbance that Would Not Be Reclaimed (Approximate Acres)
Well pads (production, injection, and test wells)	54	27	27
Power plants and substation	32	0	32
Gen-tie and switching station	1,196	1,178	18
Access roads/pipelines	40	0	40
Total	**1,322**	**1,205**	**117**

Source: Ormat GIS 2016

2.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

No alternatives other than the Proposed Action, Alternative 1, and the No Action Alternative were analyzed in detail as part of this EA. However, during draft EA preparation, the BLM considered alternative project configurations for proposed geothermal development facilities that would still meet the purpose of and need for action (**Section 1.3**). The BLM also considered alternative project configurations in response to comments received during the 2017 draft EA public comment period (**Appendix G**). These are described below.

2.3.1 Power Generation Plant Site Alternative

The BLM considered alternative power generation plant locations in the AOI. The exact location of each power plant would be dependent on site-specific engineering factors. The potential locations of the proposed power plants and facilities are limited by the bounds of the geothermal resources, geothermal lease boundaries, and other constraints (for example, WSA and military use boundaries) in the Dixie Valley. In addition, the analyzed locations were located to avoid sensitive biological and cultural resources and wetlands and riparian areas; therefore, this alternative was considered technically infeasible and would have a greater environmental impact than the Proposed Action.

2.3.2 Power Generation Plant Technology Alternative

No other reasonable power plant technology was identified; a flash steam power plant is not suitable for this project area. This is because the temperature of the geothermal resource is too low. Therefore, this alternative was considered technically infeasible.

2.3.3 Number of Power Generation Plants Alternative

The BLM considered an alternative analyzing a single power generation plant. However, based on the conceptual model of the geothermal resource in the Dixie Meadows Geothermal Unit Area, a single power generation plant would limit production capacity. Therefore, this alternative would not meet the purpose of action, which is to allow ORNI 32 to develop the geothermal resources within the Dixie Meadows Geothermal Unit Area. As described in **Section 2.1.3**, up to two plants would be built; the decision of whether to build the second plant would be based on results of additional drilling and observed behavior of the geothermal resource after the first plan commences operations.

2.3.4 Well Location Alternatives

The BLM also considered alternative locations and numbers of geothermal wells. Well numbers and locations were determined for the well pads based on the commercial potential. Well locations are in accordance with lease stipulations for cultural and riparian resources (**Appendix A**), which would minimize effects on sensitive resources. Thus, alternative well locations and numbers beyond those included in the Proposed Action were eliminated without detailed analysis because they are inconsistent with the project purpose and need.

2.3.5 Gen-Tie Alternatives

The BLM considered alternatives to constructing a new gen-tie alignment, including interconnecting to existing transmission facilities. The existing Terra-Gen 230 kV transmission line cannot be used. This is because there may not be adequate capacity to accommodate the proposed project and the line's private owner has informed ORNI 32 that they are reserving any available capacity for their own future use. Thus, the gen-tie route selection was predicated upon the gen-tie interconnecting to one of the two nearest available transmission lines with available capacity.

In the 2017 draft EA Proposed Action, ORNI 32 proposed to construct approximately 6,200 linear feet of the northern gen-tie alignment across an area containing a series of springs and associated wetlands and riparian vegetation in T22N, R35E, Sections 4, 5, and 8 in the northern portion of Dixie Meadows. The BLM received numerous public comments (**Appendix G**) requesting that this portion of the proposed gen-tie be realigned. The gen-tie that formerly crossed wetlands and riparian areas in Dixie Meadows is no longer proposed. The proposed gen-tie would follow the existing Dixie Valley Road, outside of wetlands and riparian areas (see **Section 2.1.5**).

2.4 NO ACTION ALTERNATIVE

Under the No Action Alternative, the BLM would not approve the Proposed Action, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. If exploration activities authorized under the two previous Decision Records are permanently suspended, ORNI 32 would remove and reclaim existing facilities.

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Chapter 3.
Affected Environment and Environmental Consequences

3.1 Scoping and Issue Identification

This section identifies and describes the current condition and trend of elements or resources in the human environment which may be affected by the Proposed Action or alternatives and the environmental consequences or effects of the actions.

The BLM CCD, Stillwater Field Office held an interdisciplinary team meeting on June 22, 2015. The following issues were identified as needing to be addressed in the draft EA: migratory birds, wildlife and key habitat, sensitive species, wetlands and riparian areas, invasive/nonnative species, visual resources, cultural resources, Native American religious concerns, travel management, land use authorizations, hazardous or solid waste, and socioeconomics. Subsequent coordination with the interdisciplinary team identified air quality, water resources, soil resources, public health and safety, and wilderness study areas as also needing to be addressed in detail. Public health and safety was combined with hazardous or solid waste because similar issues were identified in both.

The following issues were originally identified as not being present or affected in the proposed project area: areas of critical environmental concern, environmental justice, farm lands, forests and rangelands, threatened and endangered species, wild and scenic rivers, paleontological resources, lands with wilderness characteristics, recreation, and wild horses and burros. The supporting rationale for these determinations is provided in the table below. The BLM received comments on the 2017 draft EA requesting that the BLM reexamine potential project effects on environmental justice. As a result, this issue was brought forward for analysis in the second draft EA (see **Section 3.19**). **Section 1.7** summarizes changes to this EA since the second draft EA.

3.1.1 Supplemental Authorities

Appendix 1 of the BLM's NEPA Handbook, H-1790-1 (BLM 2008a) identifies supplemental authorities that are subject to requirements specified by statute or executive order and must be considered in all BLM environmental analysis documents (**Table 7**, below). Supplemental authorities that could be affected by the Proposed Action and alternatives are further described in this EA.

Table 7
Supplemental Authorities and Rationale for Detailed Analysis for the Proposed Action

Elements[a]	Not Present[b]	Present/ Not Affected[b]	Present/ May Be Affected[c]	Rationale
Air Quality			X	Carried forward in **Section 3.2**.
Areas of Critical Environmental Concern	X			Not present. No areas of critical environmental concern have been designated in the AOI. A portion of BLM-administered lands in the Dixie Valley were previously considered for the designation of a Dixie Valley Toad Area of Critical Environmental Concern. BLM-administered lands in the Dixie Meadows meet the considered relevance and importance criteria for such an area of critical environmental concern, including maintaining habitat and a viable population of toads (BLM Manual 1613, Areas of Critical Environmental Concern).
Cultural Resources			X	Carried forward in **Section 3.12**.
Environmental Justice			X	Carried forward in **Section 3.19**.
Farmlands (prime or unique)		X		The Proposed Action gen-tie traverses 6.6 miles of farmland of statewide importance and 10.7 miles of prime farmland, if irrigated and reclaimed of excess salts and sodium (Ormat GIS 2016); however, these areas are not currently used for agriculture. Under the Proposed Action, there would be no impacts on farmlands. The Proposed Action would not convert farmland of statewide importance or prime farmland, if irrigated and drained of excess salts and sodium, that is being used for agriculture; thus, a Farmland Conversion Impact Rating is not required, and no further consultation or coordination with the Natural Resources Conservation Service (NRCS) is required.[14]

[14] Francine Lheritier, NRCS, personal communication with Drew Vankat, EMPSi, on March 24, 2016, regarding farmland conversion impact ratings.

Elements[a]	**Not Present**[b]	**Present/ Not Affected**[b]	**Present/ May Be Affected**[c]	**Rationale**
Floodplains	X			Not present. The FEMA 100-year floodplain is located over 1 mile east of the nearest proposed well (FEMA 2008).
Invasive, Nonnative, and Noxious Species			X	Carried forward in **Section 3.10**.
Migratory Birds			X	Carried forward in **Section 3.5**.
Native American Religious Concerns			X	Carried forward in **Section 3.13**.
Threatened or Endangered Species	X			No threatened, endangered, or proposed species are known to exist in the project area. The USFWS determined that the Lahontan cutthroat trout (*Oncorhynchus clarkia henshawi*, threatened) is potentially present in the vicinity of the project area (USFWS 2016), but a subsequent habitat suitability evaluation determined it is not. Monarch butterfly (*Danaus plexippus plexippus*), a candidate species, is discussed in **Section 3.8**, Sensitive Species.
Hazardous or Solid Wastes			X	Carried forward in **Section 3.17**.
Water Quality (Surface/Ground)			X	Water Quality (Surface/Ground) is discussed and carried forward for analysis under Water Resources, **Section 3.3**.
Wetlands/Riparian Zones			X	Carried forward in **Section 3.9**.
Wild and Scenic Rivers	X			Not present.
Wilderness/Wilderness Study Areas			X	Carried forward in **Section 3.16**.

[a] See BLM Handbook H-1790-1(BLM 2008a), Appendix 1, Supplemental Authorities to be Considered.
[b] Supplemental authorities determined to be *not present* or *present/not affected* need not be carried forward or discussed further in the document.
[c] Supplemental authorities determined to be *present/may be affected* must be carried forward in the document.

3.1.2 Resources Other Than Supplemental Authorities

Resources or uses that are not supplemental authorities as defined by the BLM's Handbook H-1790-1 (BLM 2008a) are present in the project area. BLM specialists have evaluated the potential impact of the Proposed Action on these resources and documented their findings in **Table 8**, below. Resources or uses that may be affected by the Proposed Action and Alternative 1 are further described in this EA.

Table 8
Resources Other Than Supplemental Authorities

Resource or Issue	Not Present[a]	Present/ Not Affected[a]	Present/May Be Affected[b]	Rationale
Visual Resources			X	Carried forward in **Section 3.11**.
Minerals		X		Geothermal resources would not be consumed during operation due to use of a closed loop system. A sales contract with the BLM would be entered into for use of mineral materials consistent with BLM policies and regulations; as such, impacts on minerals would be negligible.
Wildlife/Key Habitat			X	Carried forward in **Section 3.7**.
Sensitive Species			X	Carried forward in **Section 3.8**.
Livestock Grazing		X		Impacts would be negligible because development would occur on a very small percentage of each allotment overlapping the project site and because there would be no reduction in animal unit months.[c]
Socioeconomics			X	Carried forward in **Section 3.18**.
Fire Management		X		A fire contingency plan is included under all action alternatives; therefore, no impacts on fire management are expected.
Soil Resources			X	Carried forward in **Section 3.4**.
Public Health and Safety				Carried forward in **Section 3.17**.
Paleontological Resources	X			There are no known paleontological resources in the project area. The entirety of the project area is located in an area of potential fossil yield classification (PFYC) 2 (low), a geologic unit that is not likely to contain paleontological resources. PFYCs and recommended management actions for each class are described in the BLM Instruction Memorandum 2016-124.

Resource or Issue	Not Present[a]	Present/ Not Affected[a]	Present/May Be Affected[b]	Rationale
Lands with Wilderness Characteristics	X			Lands with wilderness characteristics are not present in the project area.
Recreation		X		Numerous access roads in the vicinity allow for dispersed recreation to continue. Project construction would be temporary in nature; any recreation access restrictions would only take place during construction and on active well pads. Applicant-committed EPMs (**Appendix J**, **Section J.1.4**), such as painting project components to blend with the area, reducing noise, and implementing dust control measures, would avoid impacts on the recreation setting. Dark sky-compliant lighting practices (**Appendix J, Section J.2.1**) would avoid light trespass and associated effects on recreational night sky viewing from adjacent areas. These visual resource considerations are analyzed in detail in **Section 3.11**.
Land Use Authorizations			X	Carried forward in **Section 3.15**.
Travel Management			X	Carried forward in **Section 3.14**.
Vegetation			X	Carried forward in **Section 3.6**.
Water Resources			X	Carried forward in **Section 3.3**.
Wild Horses and Burros		X		There are no herd areas or herd management areas that overlap or occur within the project area. Wild horses do move through Dixie Valley and utilize some springs in the valley for water. However, the proposed project would not be anticipated to impact horses utilizing the valley. There are no known wild burros present.

Resource or Issue	Not Present[a]	Present/ Not Affected[a]	Present/May Be Affected[b]	Rationale
Greenhouse Gas and Global Climate		X		Although the Proposed Action would contribute to an increase in greenhouse gases in the atmosphere, these emissions would be extremely small relative to state, national, and global greenhouse gas emissions. Any resultant effects would also be extremely small and cannot be reliably estimated or analyzed.

Source: BLM 2008a

[a] Resources or uses determined to be *not present* or *present/not affected* need not be carried forward or discussed further in the document.
[b] Resources or uses determined to be *present/may be affected* must be carried forward in the document.
[c] An animal unit month is the amount of forage required by one animal unit for 1 month. An animal unit is generally one mature cow and a calf, or their equivalent.

3.1.3 Resources or Uses Present and Brought Forward for Analysis

The following resources are present in the project area and may be affected by the Proposed Action, and are carried forward for analysis:

- Air quality
- Water resources
- Soil resources
- Migratory birds
- Vegetation
- Wildlife and key habitat
- Sensitive species
- Wetlands and riparian areas
- Invasive, nonnative, and noxious weeds
- Visual resources
- Cultural resources
- Native American religious concerns
- Travel management
- Land use authorizations
- Wilderness study areas
- Public health and safety and hazardous materials
- Socioeconomics
- Environmental justice

3.2 AIR QUALITY

3.2.1 Affected Environment

The United States Environmental Protection Agency (USEPA) and State of Nevada have designated the Nevada Department of Conservation and Natural Resources, NDEP BAPC, and Bureau of Air Quality Planning as the authorities that regulate air pollution and quality in the state, except for Clark and Washoe Counties.

The Combined Dixie Meadows Geothermal Unit Area (NVN-89456X) is exclusively situated in Churchill County. In the Proposed Action, the gen-tie is located in both Churchill and Pershing Counties. In Alternative 1, the gen-tie is only located in Churchill County. Both Churchill and Pershing Counties are classified as attainment areas, indicating that they have air quality that meets or is superior to the National Ambient Air Quality Standards (NAAQS). The NAAQS identify primary, or criteria, pollutants that cannot exceed emission levels based on public health concerns. These pollutants include carbon monoxide, lead, nitrogen dioxide, ozone, particle pollution, and sulfur dioxide.

Under Section 162(a) of the Clean Air Act, certain federal lands defined as Federal Class 1 Areas, such as national parks, national wilderness areas, and national monuments, are granted special and the most restrictive air quality protections. There are no Federal Class 1 Areas located in the project site, with the nearest being the Desolation Wilderness Area, which is approximately 121 miles away from the project site. Due to the long distance between these two sites, laws and regulations associated with Federal Class 1 Areas are not applicable to the project area.

3.2.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)

Emissions produced during grading and construction, including from vehicle use, are short term and would cease upon completion of construction. Similarly, emissions produced during drill rig operation would be short term and would cease upon drilling completion.

Application of water or other dust suppressants to disturbed areas would minimize dust (see **Appendix J**, **Section J.1.4**). A Surface Area Disturbance permit from the NDEP BAPC would be obtained prior to the start of construction. Construction would comply with all the requirements of that permit. Once the plants are operational, the Surface Area Disturbance regulation would continue as a part of the project's Air Quality Operating permit.

The proposed binary turbine power plant(s) would use butane, a flammable but non-toxic hydrocarbon, as the binary fluid, which circulates in a closed loop. During normal operations and maintenance, an average of approximately 12 tons per year of butane per plant would be released into the atmosphere. In a review of three geothermal power plants in California, Mattson et al. (2017) found "normal" leakage of binary fluid to be between 74 and 292 pounds of isobutane per day (13.5 and 53.3 tons per year, respectively), with the higher-end numbers attributable to equipment malfunction or breakdown. While anticipated releases under the Proposed Action would be less, the potential exists for releases to be higher than anticipated, especially in the case of malfunctioning equipment.

Releases would be regulated through a Class II permit issued by NDEP BAPC, to ensure emissions do not result in ambient concentrations of ozone (which can be created from the reaction of ambient concentrations of hydrocarbons and nitrogen oxides) in excess of the applicable Nevada Ambient Air Quality Standards. Thresholds for Class II permits are less than 100 tons per year for any one regulated pollutant. This would mitigate or avoid air quality impacts from equipment operations and maintenance.

Some liquid motive fluid would be stored on-site in a tank. When the binary power plant unit is opened, motive fluid liquid and vapor would first be removed from the system and returned to the storage tank. NDEP's BAPC would issue a permit to ensure ambient concentrations of ozone from these sources would not exceed applicable Ambient Air Quality Standards.

Combustion emissions of criteria air pollutants (nitrogen dioxide, sulfur dioxide, carbon monoxide, and particulate matter less than or equal to 10 microns in diameter), criteria air pollutant precursors (volatile organic compounds [VOCs]), and air toxics (small quantities of diesel particulate matter, acetaldehyde, benzene, and formaldehyde) would be released from diesel engines used during well drilling and construction activities. Because these are short-term emission sources, the potential impacts resulting from these short-term emissions are expected to be minimal. Small quantities of naturally occurring non-condensable gases, such as carbon dioxide, hydrogen sulfide, nitrogen, and methane, would be emitted to the air during geothermal well testing.

Alternative 1 (Southern Gen-tie Route)

Impacts would be similar to those described under the Proposed Action; however, since the southern gen-tie route is approximately 17 miles shorter than the northern gen-tie route, impacts would be slightly reduced under this alternative. This is because construction would occur over a shorter period and there would be fewer acres of temporary ground disturbance during construction.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the Proposed Action, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision

Records for the foreseeable future. As such, a minor decrease in air quality impacts would result due to a suspension of exploration activities.

3.3 WATER RESOURCES

3.3.1 Affected Environment

Geologic and Hydrogeological Setting

This section discusses the regional geologic and hydrogeological setting of Dixie Valley, with a focus on the geology of the Stillwater Range and basin, as the project area is located along the western-central periphery of Dixie Valley at the base of the Stillwater Range.

Physiography

Dixie Valley is an endorheic basin[15] between the Stillwater Range to the west and the Clan Alpine Range to the east. The basin floor consists of alluvial fans with a relatively flat valley bottom; a 70-square-mile playa, the Humboldt Salt Marsh, is present and periodically flooded following storms.

The project area is located in west-central Dixie Valley, at the base of the Stillwater Range and southwest of the Humboldt Salt Marsh. It is characterized by alluvial fan deposits in the west, lacustrine (playa) deposits in the east, and a wetland area, referred to as Dixie Meadows, that is fed primarily by discharge from seeps, springs, and periodic stormwater runoff from the Stillwater Range. Discharge from seeps and springs at and near Dixie Meadows is a mixture of freshwater and geothermal fluid. Two ephemeral ponds, which are believed to be seismically created land features, exist in the eastern portion of Dixie Meadows (see Figure D1 in Appendix D of the ARMMP [**Appendix H**]).

Regional and Basin Geology

The oldest units in the Stillwater Range are early Triassic pelites, quartz arenites, clastic and micritic limestones, and dolomites (Nimz et al. 1999). The late Triassic section of the Stillwater Range is a thick sequence of pelitic rocks that are overlain by Triassic-Jurassic calcareous pelites (Nimz et al. 1999). Deformed lower Jurassic carbonates, calcarenites, and pelitic rocks overlay these rocks or are in thrust fault contact. The Jurassic Humboldt Lopolith (coarse-grained gabbros, picrites, anorthosites) overlies the Triassic section of the Stillwater Range at a thrust-fault contact (Speed 1976). Cretaceous granodioritic bodies have intruded the Mesozoic sequence of the Stillwater Range (EGS [Engineered Geothermal Systems] 2014a). Mid-Cenozoic silicic tuffs occur in both the Stillwater and Clan Alpine Ranges, and each range is capped by Late-Cenozoic basalts (Nimz et al. 1999).

The Dixie Valley basin-fill is composed of Quaternary-Tertiary sediments derived from the surrounding mountain ranges, and Tertiary volcanic rocks. The

[15] The basin retains water and allows no outflow to other basins.

thickness of the basin-fill reaches up to 8,200 feet toward the center of the basin (EGS 2014a). The basin-fill sediment becomes progressively consolidated with increasing depth. The basin-fill sediments thicken to 5,000 feet at well 42-9. Tertiary volcanic rocks, including rhyolitic pyroclastic deposits and basalt flows, generally underlie the alluvial materials (see Figure 5 and Figure D1 in Appendix D of the ARMMP [**Appendix H**]).

Tertiary volcanic rocks, including rhyolitic pyroclastic deposits and basalt flows, generally underlie the alluvial materials, except along the moderately dipping Dixie Valley Fault where the alluvial sediments are juxtaposed against Triassic slate and siltstone. The Oligocene rhyolitic pyroclastic deposits include ash flow tuffs and air-fall deposits, which correlate to welded silicic tuffs exposed in the Stillwater and Clan Alpine Ranges. Miocene basalt flows and lacustrine volcaniclastic deposits overlie the Oligocene section (EGS 2014a).

Structural Geology

The Dixie Meadows area is located adjacent to and east of the northern segment of the northeast-striking Dixie Valley Fault Zone, along the eastern flank of the Stillwater Range. There are also several older reactivated fault structures adjacent to Dixie Meadows that strike east-northeast; these structures have been determined during geothermal exploration activities to be the primary source of geothermal fluids at the Dixie Meadows geothermal field.

The Dixie Valley Fault is the primary range-front normal fault separating the bedrock of the Stillwater Range from the Cenozoic basin-fill sediments. Results from recent drilling and geophysical surveys near Dixie Meadows indicate that the Dixie Valley Fault at and near Dixie Meadows has a moderate dip of approximately 47 degrees southeast. This is contrary to findings along other portions of the Dixie Valley Fault Zone, where the fault plane is a higher-angle feature normal fault (EGS 2014a, 2014b; Blackwell 2005). The locally shallow dip of the Dixie Valley Fault at Dixie Meadows is reflected in seismic geophysical surveys by EGS (2014a, Section A-A, Appendix 12), Abbott et al. (2001), and Kennedy-Bowdoin et al. (2004). A vertical displacement of approximately 1.9 miles along the Dixie Valley Fault is based on Late Miocene basaltic ash-flow tuffs observed in both the Stillwater Range and beneath the basin-fill alluvium (EGS 2014a).

The Dixie Valley Fault Zone is the producing reservoir at the existing Terra-Gen Dixie Valley Power Plant, located about 16 miles northeast of Dixie Meadows. At that site, the Dixie Valley Fault Zone ranges in width from approximately 1.2 to 2.4 miles and incorporates the range-bounding Dixie Valley Fault, a Piedmont Fault, and associated intra-basin faults (EGS 2014b; see Figure 5 and Figure D1 in Appendix D of the ARMMP [**Appendix H**]). It is considered one of the most active fault zones in the Basin and Range Province (EGS 2014a). The 1954 Dixie Valley earthquake (magnitude 6.8) epicenter was at the mouth of Hare Canyon, directly west of the Dixie Meadows area. Smith (2001) believes the event probably rejuvenated or even initiated the Dixie Meadows spring flow. The ponds on the east side Dixie Meadows are likely associated with liquefaction that is known to have occurred during the 1954 earthquake, or perhaps earlier tectonic events along the active fault zone (Wesnousky 2003).

An earthquake with an estimated magnitude of 7.3 (Wesnousky 2003) occurred along the Dixie Valley Fault Zone approximately 2,400 to 3,000 years ago (Pearthree 1990). This event may also be responsible for rejuvenation of permeability and hydrothermal fluid transport in the producing geothermal reservoir and at several fumaroles along the range front fault between the Dixie Hot Springs and the north end of the Dixie Valley. The earthquake resulted in liquefaction of soils, resulting in a linear zone of compressed soils parallel to and east of the Piedmont Fault and Dixie Meadows. The compressed soils zone along the playa margin is strongly developed east of Spring Complex 2, and is believed to have formed the topographic depressions that are the playa ponds to the east of Dixie Meadows (Wesnousky 2003).

Local geophysical and drilling data suggest significant normal displacement along a Piedmont Fault plays a crucial role in the geothermal producing field in Dixie Valley (the existing power plant north of Dixie Meadows [EGS 2014b]). EGS (2014a) states that geothermal fluids derived from the piedmont structure are known to occur at deeper levels, but the Piedmont Fault does not appear to contribute hot fluids to the shallow thermal regime at the Dixie Valley power plant(s).

At Dixie Meadows, geothermal reservoir exploration has not identified that the Dixie Valley Fault, or Piedmont Faults, contribute to significant geothermal fluid flow. Rather, a set of cross-cutting east-northeasterly faults have been identified within the Dixie Valley Fault Zone by exploratory drilling to constitute the primary permeability and greatest temperatures, and is thereby defined as the geothermal reservoir (see Figure 5 in **Appendix H,** Figure M0 in **Appendix M**, and the exploration discussion in **Appendix L)**.

Hydrogeology Overview

Warm and hot springs that line the western perimeter of the Dixie Meadows are believed to be geologically young features that formed from seismic events; these seismic events created new faults or rejuvenated existing faults, which act as permeable conduits for geothermal groundwater to ascend from depth. Thermal waters migrate upward through these fault zones, discharge into basin-fill sediments and mix with shallow groundwater, then flow toward the Dixie Valley playa, and in some cases, discharge to the surface through the springs of Dixie Meadows.

Geothermal aquifers are present in Dixie Valley in both the alluvium and underlying bedrock. The high-temperature geothermal resource is expected to occur within the bedrock at depths ranging from 4,000 to 10,000 feet below ground surface. This geothermal resource is expected to be confined by low-permeability clay, shale, siltstone, and clay-altered volcanic rocks. Geothermal groundwater migrates upward along permeable structures, discharges into basin-fill sediments, and flows toward the center of the basin in the shallow subsurface (EGS 2014a). In some cases, geothermal water escapes to the surface through hot springs and steam vents.

Geothermal gradients measured in wells throughout the valley, and geochemical and isotopic data from shallow wells indicate considerable input of geothermal fluids into shallow alluvial aquifers.

Climate Setting

The climate of Dixie Valley is typical for valleys within the Great Basin. The basin floor is arid, characterized by low annual precipitation and high evaporation rates. The region generally experiences hot summers with little precipitation and cold winters with moderate amounts of precipitation, which is predominantly snowfall. The majority of precipitation falls from December through May.

Garcia et al. (2014) reported 5 to 8.6 inches of precipitation on the playa (elevation 3,383 feet above mean sea level [amsl]) floor between 2010 and 2011, while the valley floor weather station at the Navy Centroid Facility (elevation 4,235 feet amsl) reported an average of 8.97 inches per year between 2006 and 2015 (WRCC 2020). The Paris Ranch weather station in northern Dixie Valley reports average annual precipitation at this location of 8.99 inches from 1966 to 1991 (WRCC, 2020), while the Middlegate Lowery weather station to the southeast of Dixie Valley indicates average precipitation of 5.68 inches from 1988 to 2013 (WRCC 2020). Data collected in the mountain ranges by Interflow (2016) from 2010 to 2015 indicate average annual precipitation of 18.0 inches at 8,210 feet amsl in the Clan Alpine Range and 15.0 inches at 6,015 feet amsl in the Stillwater Range (Interflow 2016).

Surface Water

Ephemeral streams fed by significant precipitation events or snowmelt, and intermittent streams fed by seeps and springs are present in Dixie Valley (Huntington et al. 2014). Springs and seeps exist in the mountain blocks, along fault scarps at the mountain block/valley floor interface, and where shallow groundwater breaches the surface on the valley floor. Typically, cool and fresh water discharges from mountain-block springs at less than 1 gpm (Interflow and Mahannah 2012a). Valley floor spring discharge rates range from less than 1 to 300 gpm, and temperatures range from 39 to more than 140°F (Interflow and Mahannah 2012a). High temperature spring discharge indicates a geothermal-source component (see *Groundwater and Geothermal Resources*, below).

Sources of surface water and groundwater recharge to Dixie Valley include precipitation, mountain-block runoff, surface water inflow from adjacent basins, and groundwater inflow from adjacent basins. Because Dixie Valley is a terminal basin, surface water and groundwater outflow to adjacent basins is considered negligible. Dixie Valley is typical of many basin and range valleys in Nevada and has been filled with thousands of feet of unconsolidated deposits of alluvial and lakebed sediments. Surface water flows onto the valley floor only in response to significant rainfall and snowmelt events in the adjacent mountains. It travels down ephemeral drainages to the valley bottom where it collects on the playas and then evaporates (see **Figure 7** in this document and Figure D3 in Appendix D of the ARMMP [**Appendix H**]).

At the lowest elevation of the playa in Dixie Valley there is a perennial brine pool which is called the Humboldt Salt Marsh. In an average year, minimal surface water reaches the playa, as the majority of runoff infiltrates along alluvial fans; however, major precipitation events can cause surface water to flow to it (Interflow and Mahannah 2013). Estimated average total annual runoff to the playa was estimated by Interflow (2016) at 500 acre-feet/year.

Two smaller adjacent ephemeral ponds are present east of the Dixie Meadows hot springs in T22N, R35E, Section 9 (spring Complex 2 in Figure 16 of the ARMMP; **Appendix H**) and at a slightly higher elevation than the Humboldt Salt Marsh. The western pond appears to be the end point for much of the water that originates from this spring complex; it contains seasonal standing water in winter when evaporation rates are low. The smaller eastern pond receives outflow from the western pond and is more often dry. A third pond, located in T22N, R35E, Section 20, receives runoff from upgradient areas, but it is usually dry.

Hot and Cold Springs

A series of hot, warm, and cold springs and seeps are present in the lease area. Most of these are located on the Navy lands, primarily in T22N, R35E, Sections 4, 5, 8, and 17. There are additional springs on BLM-administered lands in Sections 4 and 19. The origin of these springs is unknown, but are thought to have originated from lateral shallow thermal flow from upwelling to the west of Dixie Meadows along the Dixie Valley Fault or other east-to-northeast-trending faults, or vertical up-flow along the Piedmont Fault. Both potential flow paths for Dixie Meadows thermal springs are discussed in EGS (2014a, p. 44).

The shallow lateral flow is defined from temperature-gradient data from borehole 8g1 (EGS 2014a, Figure 31). ORNI 32's continued exploration of the geothermal resources at Dixie Meadows (see Appendix L) further corroborates the interpretation of a shallow lateral flow system of upwelled thermal waters to the west of the Piedmont Fault. Temperature-gradient profiles are included as Figure D2 in Appendix D of the ARMMP (Appendix H). While data define a lateral hydrothermal water flow component, this does not preclude a component Dixie Meadows spring source from upwelling along the Piedmont Fault. Temperature-gradient data do not support the existence of an economic-grade thermal condition along the Piedmont Fault; rather, the exploration

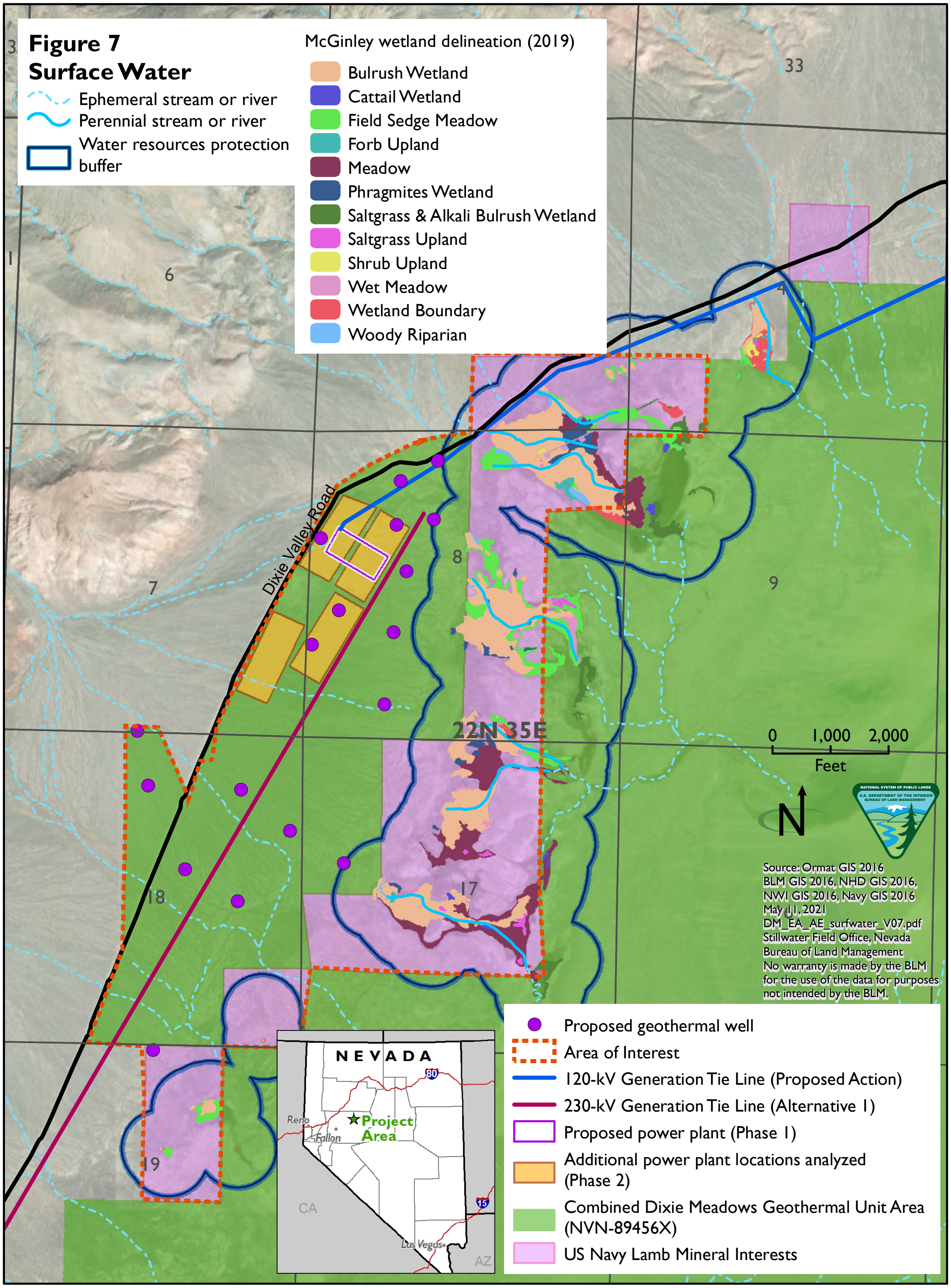
Figure 7
Surface Water
Ephemeral stream or river
Perennial stream or river
Water resources protection buffer
McGinley wetland delineation (2019)
Bulrush Wetland
Cattail Wetland
Field Sedge Meadow
Forb Upland
Meadow
Phragmites Wetland
Saltgrass & Alkali Bulrush Wetland
Saltgrass Upland
Shrub Upland
Wet Meadow
Wetland Boundary
Woody Riparian
Dixie Valley Road
22N 35E
0 1,000 2,000
Feet
N
Source: Ormat GIS 2016
BLM GIS 2016, NHD GIS 2016,
NWI GIS 2016, Navy GIS 2016
May 11, 2021
DM_EA_AE_surfwater_V07.pdf
Stillwater Field Office, Nevada
Bureau of Land Management
No warranty is made by the BLM
for the use of the data for purposes
not intended by the BLM.
NEVADA
Reno
Fallon
Project Area
CA
AZ
Las Vegas
Proposed geothermal well
Area of Interest
120-kV Generation Tie Line (Proposed Action)
230-kV Generation Tie Line (Alternative 1)
Proposed power plant (Phase 1)
Additional power plant locations analyzed (Phase 2)
Combined Dixie Meadows Geothermal Unit Area (NVN-89456X)
US Navy Lamb Mineral Interests

drilling conducted by Ormat between 2011 to 2020 (see **Appendix L**) identified an economic-grade geothermal reservoir farther to the west. The mixed cold, warm, and hot temperatures of spring discharge in Dixie Meadows can be conceptually supported by the lateral flow component.

A weak fumarole[16] from faulted bedrock at the mountain-front fault is the result of either some upwelling of geothermal fluids at the Dixie Valley Fault Zone or convective heating of meteoric groundwater. Ormat exploration drilling did not encounter high fracture permeability along the fault plane of the Dixie Valley Fault Zone. Rather, high permeability was encountered deeper in the Triassic bedrock in cross-cutting east-northeast faults (see **Appendix L** for additional details).

The relatively shallow lateral geothermal groundwater flow identified in temperature-gradient logs of boreholes at the project area is the result of upwelled thermal waters, which mix with meteoric (cool) shallow groundwater.

The geothermal reservoir and interpretations of thermal water flow paths to Dixie Meadows springs are illustrated in Figure 5 of the ARMMP (**Appendix H**) and Figure M0 in **Appendix M**. Waters are interpreted to move up the east-northeast striking fault structures to mix with shallower cool groundwater, which then flows laterally to the east in the down-gradient direction toward the valley floor and Dixie Meadows (see Figure 5 in **Appendix H** and Figure M0 in **Appendix M**).

As summarized by Interflow (2019), during the most recent glacial epoch, the Pleistocene Lake Dixie high stand peaked at an elevation of 3,600 feet amsl approximately 13,000 years before present. What is now the Dixie Meadows area was inundated by up to 190 feet of water. Inundation extended from approximately 35,000 to 8,000 years before present. Spring water chemistry in Dixie Meadows is similar to other thermal springs in Dixie Valley that were submerged by Pleistocene Lake Dixie, such as Hyder and Seven Devils Springs (Interflow and Mahannah 2012a). However, while significant tufa mounds formed at Hyder and Seven Devils Springs, they have not formed at Dixie Meadows. This may suggest that the Dixie Meadows springs formed post Pleistocene Lake Dixie, after approximately 8,000 years before present. Additionally, the geographical relationship between Dixie Meadows springs and the Piedmont Fault scarp supports that the springs may have been formed during the earthquake event that occurred between 2,400 to 3,000 thousand years ago.

An inventory of springs, seeps, and previously established monitoring control sites (collectively referred to as the "spring inventory") was conducted during preparation of the ARMMP. The results of the spring inventory were used to

[16] An opening in or near a volcano (steam vent), through which hot sulfurous gases emerge

establish baseline monitoring and control sites (see **Section 5.1** in **Appendix H** and **Section J.2.3** in **Appendix J**). In total, there are 117 field-verified spring and seep features. Locations of field-verified springs and seeps are presented in Figure 7 of the ARMMP (**Appendix H**). A table summarizing spring locations and detailed figures of spring locations is included as Appendix E of the ARMMP (**Appendix H**).

Spring discharge rates ranged from 15 to 146 gpm in May 2019, as summarized in Table 9 of the ARMMP. The amount that runs off from spring Complex 2 is estimated to be at least 25 to 50 acre-feet/year, which is sufficient to fill the ephemeral ponds described above, in the winter. Small drainages and pools can be observed at the playa edge below the primary spring groups, but the extent of the pools is small, suggesting that the amount of winter runoff from the springs to the playa is relatively small. Surface water runoff to the main Dixie Valley playa is assumed to be about approximately 5 percent of overall spring discharge, or approximately 45 acre-feet/year, as described in Appendix D, Section 1.2.6, of the ARMMP (**Appendix H**).

The hottest springs are located in the central portion of this series of springs, in spring Complex 2, while cooler-temperature springs exist to the north and south. Temperatures of surface water discharge have been reported to range from 84°F (29°C) at discharge points in the south, to 137.3°F (58.5°C) at the Dixie Hot Springs (spring Complex 2; see Table 9 in the ARMMP; **Appendix H**).

Spring Monitoring and Water Quality

As part of the interagency Groundwater Export Study (Huntington et al. 2014), the USGS, US Bureau of Reclamation, Nevada State Engineer, and Churchill County inventoried, sampled, and monitored streams, springs, and wells, and collected precipitation and evapotranspiration data throughout Dixie Valley between 2009 and 2011.The USGS National Water Information System[17] shows two water quality observations at two springs near the lease area in 2009. Spring USGS-301 (T22N, R35E, Section 17) was monitored on October 27, 2009. The surface water temperature was 84°F (29°C). Spring USGS-101 (T22N, R35E, Section 4) was monitored on October 30, 2009. The surface water temperature was 79°F (26°C). Surface water temperature was 26 °C (79 °F). Additional water quality parameters are included below:

- Total dissolved solids (TDS) = 565 to 829 milligrams per liter (mg/L)
- Specific conductance = 1,150 to 1,390 microsiemens per centimeter
- pH = 7.8 to 8.5 standard units

[17] Internet website: https://waterdata.usgs.gov/nwis

- Hardness = 34 to 60 mg/L
- Alkalinity = 84 to 86 mg/L
- Calcium = 11.3 to 22.8 mg/L
- Magnesium = 0.59 to 1.34 mg/L
- Sodium = 170 to 249 mg/L
- Potassium = 1.15 to 2.97 mg/L
- Chloride = 146 to 289 mg/L
- Sulfate = 107 to 129 mg/L
- Silica = 48.2 to 60.2 mg/L

Additional water quality data for the Dixie Hot Springs in Section 5 are available from the Great Basin Center for Geothermal Energy (2016). Two water samples (DV97-69 and DV98-120) collected in 1997 and 1998, respectively, had the following selected characteristics:

- TDS = 665 to 723 mg/L
- Specific conductance = 1,006 to 1,011 microsiemens per centimeter
- pH = 7.2 to 8.1 standard units
- Temperature = 180 to 183°F (82 to 84°C)
- Bicarbonate = 71 to 94 mg/L
- Calcium = 10.7 to 11.0 mg/L
- Magnesium = 0.12 to 0.22 mg/L
- Sodium = 194 to 211 mg/L
- Potassium = 4.9 mg/L
- Chloride = 161 to 162 mg/L
- Sulfate = 121 to 139 mg/L
- Silica = 105 to 107 mg/L

The Dixie Meadows Water Resources Monitoring Plan (Ormat 2011) identified three proposed surface water monitoring stations: SP-1 (NDOWSS-1; T22N, R35E, Section 5), SP-2 (NDOWSS-2; T22N, R35E, Section 17), and SW-1 (small playa; T22N, R35E, Section 9). Spring discharge rates (flow), temperature, electrical conductivity (EC), pH, and selected analytes (for water quality analysis) were to be collected for the proposed surface water monitoring locations. Surface water monitoring was to occur quarterly for the first 2 years. After the first 2 years, surface water monitoring was to occur semiannually. ORNI 32 did not collect required surface water monitoring data as outlined in the Dixie

Meadows Water Resources Monitoring Plan (Ormat 2011) from October 2011 to September 2016.

On September 27, 2016, ORNI 32 measured springs and seeps for flow, EC, temperature, and pH as part of the Dixie Meadows Water Resources Monitoring Plan (Ormat 2011) outlined for geothermal exploration; no previous data were collected prior to 2016. The sites visited were Dixie Corral Spring (USGS-101; T22N, R35E, Section 4), the main Dixie Meadows Hot Spring (NDOWSS-1; T22N, R35E, Section 5), and a warm spring (NDOWSS-2; T22N, R35E, Section 17). **Table 9**, below, outlines collected data.

Table 9
Seep and Spring Field Data, September 27, 2016

Site	Location	Flow Rate	EC[1]	Degrees Fahrenheit	pH
Corral Spring (USGS-101)	Small pool just outside old fence	Seep into marshy wetland. Flow not measurable.	860	67.2	8.1
NDOWSS-1 (main hot spring)	Sampled just below pipe discharge	Estimated at 5 gpm at pipe. Multiple springs in area converge into one channel about 150 feet downstream. Flow there is estimated at 50 to 60 gpm.	1,320	>120[2]	Not reported
NDOWSS-2 (Section 17)	Deep pool behind salt cedar	None	1,240	77.1	8.3
NDOWSS-2 (Section 17)	Pool at edge of grass	None	1,280	86.7	8.2

Source: Ormat 2016
[1] Electrical conductivity (microsiemens per centimeter)
[2] Temperature at this spring exceeded range of thermostat

McGinley & Associates (2018-2020) has monitored locations USGS-101, NDOWSS-1, USGS-301, and monitoring well MW-1 (T22N, R35E, Section 9) quarterly since August 2018 and has sampled and monitored other monitoring locations (see Figure 16 of the ARMMP; **Appendix H**) less frequently to further establish baseline conditions and inform the hydrogeologic conceptual model. Historical data at USGS-301 North, NDOWSS-1, the western playa pond, USGS-101, and Spring 2 were provided by Rubicon Environmental Consulting (Rubicon 2018). For each monitoring location, a summary of field parameters (water temperature, conductivity, TDS, dissolved oxygen, pH, oxidation-reduction potential, and water depth) is presented in Table 6, and water chemistry results are presented in Table 7 of the ARMMP (**Appendix H**).

Water samples can be divided into three field-temperature classes; a water temperature of less than 68°F is considered cold water with low potential of geothermal influence, temperature between 68 and 122°F is considered warm water indicating potential geothermal influence, and temperature over 122°F is considered hot water that is influenced by geothermal water. Geothermal water chemical indicator concentrations vary with water temperature, as discussed in Section 1.4 and Appendix D of the ARMMP (**Appendix H**). In summary, relationships between water temperature and constituent concentrations suggest that key indicators of geothermal water include high concentrations of silica and low concentrations of magnesium. Table 7 of the ARMMP (**Appendix H**) presents a summary of geochemical indicators of evaporite-rich playa water, geothermal brine, and fresh groundwater/surface water mixing.

Groundwater

Groundwater in Dixie Valley occurs in alluvial aquifers and bedrock fractures. Groundwater is most prevalent within the alluvial aquifers, where flow occurs through the pores of unconsolidated sediment. Shallow groundwater is stored in unconfined, semi-confined, and confined (i.e., artesian) aquifers. Artesian aquifers in Dixie Valley are pressurized from recharge occurring in higher-elevation alluvial fans and mountains. Groundwater flow in consolidated bedrock, and in some instances consolidated alluvium, is controlled by secondary permeability, or faults and fractures.

Deep groundwater within consolidated rock has been located in several geothermal aquifer systems (Benoit 2011) up to 20,000 feet below ground surface (Blackwell et al. 2003). The regional groundwater flow direction follows the topographic gradient from the surrounding mountains toward the Humboldt Salt Marsh, where groundwater levels are near the land surface.

Groundwater movement in unconsolidated sediments is controlled by hydraulic conductivity of the materials, which tends to have a horizontal preference, while groundwater in consolidated bedrock is controlled by structures. Geothermal fluid has a vertical flow preference along the plane of the fault. Results of flow test data suggest that faults in Dixie Meadows have varying degrees of permeability and influence on the flow system, and that there is a hydraulic connection between the bedrock and alluvial aquifers. Flow directions are determined by the local hydraulic gradient, which follows topography, but are also governed by potentiometric gradients caused by temperature differences (hotter water has a lower density than cool water) and TDS concentrations (high TDS water has a higher density than low TDS water).

ORNI 32 compiled information on existing wells within and adjacent to the project area as well as information available from the NDWR online well log database. In the ARMMP (**Appendix H**), locations of existing wells and boreholes are indicated in Figure 3, and well completion details are provided in Table 1.

The project area is located in the Dixie Valley Hydrographic Area (Basin 128 of 256 in the state of Nevada). This hydrographic area is part of the Central Hydrographic Region (number 10 of 14 in the state of Nevada), which is by far the largest hydrographic region in Nevada at nearly 30 million acres. The Dixie Valley Hydrographic Area is 833,920 acres, or less than 3 percent of the Central Hydrographic Region. The Dixie Valley Hydrographic Area is a Nevada State Engineer-designated area or groundwater basin (NDWR 2015). The State Engineer designates groundwater basins when permitted groundwater rights approach or exceed the estimated average annual perennial yield that has been defined for the basin or area, and the water resources are being depleted or require additional administration to avoid over-draft. The Dixie Valley Hydrographic Area (Basin 128) was designated in 1978.

The NDWR (2020) lists the perennial yield of Basin 128 as 15,000 acre-feet/year. The hydrographic basin summary for Basin 128 lists a total appropriated underground water rights of 15,218.28 acre-feet/year, with the major appropriation of groundwater as irrigation (8,770.38 acre-feet/year), and industrial (5,856.34 acre-feet/year); the remaining uses are quasi-municipal, stockwater, and wildlife. Geothermal permits are considered industrial (12,704 acre-feet/year), but are commonly non-consumptive (pumped water returned via injection) and not hydrologically connected to shallower groundwater resources that are associated with other manner or uses. Therefore, the geothermal permits are not added to the committed total rights for underground waters.

Groundwater levels in Dixie Valley have remained generally constant since the 1950s. Observed changes are mostly in areas of historical, localized development as a result of withdrawals for irrigation, livestock, and domestic use, and from augmentation of geothermal reservoir pressure (Huntington et al. 2014).

Groundwater in Dixie Valley occurs in two separate but related aquifer systems: a shallow, non-thermal, basin-fill aquifer system; and a deep, locally thermal, basement rock aquifer (Karst 1987). Groundwater is most prevalent within the alluvial aquifers, where flow occurs through the pores of unconsolidated sediment. The thickness of the alluvium that makes up the basin-fill increases toward the center of the valley, reaching depths upward of 8,000 feet below ground surface. Groundwater in the alluvial deposits that comprise much of the upper basin-fill occurs under unconfined, semi-confined, and confined (i.e., artesian) conditions. Hydraulic heads are commonly beneath the elevation of the land surface, but in some areas of Dixie Valley potentiometric water levels are above land surface, and artesian flowing wells exist. Artesian wells are numerous in the Settlement area south of the Dixie Valley playa. Artesian aquifers in Dixie Valley are pressurized from recharge occurring in higher-elevation alluvial fans and mountains. Monitoring well MW-1, completed to a depth of 451 feet, is located near the alluvium-playa interface in Dixie Meadows and flows under artesian conditions (see Table 1 of the ARMMP in **Appendix H**). Groundwater flow in consolidated bedrock and in some instances consolidated alluvium is controlled by faults and fractures.

Aquifer testing in Dixie Valley was conducted in 2012 to provide information on the hydraulic properties of the basin-fill aquifer (Interflow and Mahannah 2012b). Wells tested were the main reservoir pressure support well at the Terra-Gen Dixie Valley plant, an agricultural irrigation well in northern Dixie Valley, and a flowing artesian well located near the abandoned settlement area of central Dixie Valley. Transmissivity values of the basin-fill aquifer in the northern Dixie Valley ranged from 10,000 to 17,000 square feet per day; in the central Dixie Valley, transmissivity was measured at 800 square feet per day. The USGS estimates of transmissivity in the central and southern Dixie Valley ranged from 400 to 2,500 square feet per day (Interflow and Mahannah 2012b).

In the lease area near the valley floor, the playa deposits can be generally characterized as a complex, interfingering, and laterally discontinuous sequence of thin permeable layers of sand or gravel separated by thicker, low-permeability confining layers of silt and clay. Groundwater in the Dixie Valley playa is chemically distinct from the groundwater in the alluvial deposits. Groundwater mixing between playa and alluvial fill groundwater systems is also likely physically impeded by transmissivity contrasts of about four orders of magnitude (Huntington et al. 2014). Therefore, groundwater flow and exchange between the basin-fill aquifer and playa are physically and chemically limited.

Concentrations of TDS in the playa groundwater range from about 184,000 to 310,000 mg/L (average 247,000 mg/L), which is 5–9 times greater than that of seawater (about 35,000 mg/L; Huntington et al. 2014). The high TDS of playa groundwater classify it as a brine (Drever 1982).

Groundwater in the basin-fill deposits moves from mountains toward the central part of the valley, eventually discharging at or near the playa edge. Discharge upgradient from and along the edges of the playa provides additional evidence of minimal mixing between fresh groundwater and the playa brine (Huntington et al. 2014).

Groundwater that discharges in springs may be influenced by one or more north-south-trending faults that act as either barriers to lateral flow of cool groundwater originating in the Stillwater Mountains or as a conduit that allows seepage of deep geothermal fluids to the surface. As a barrier, the faults would inhibit the migration of shallow groundwater moving from west to east and force it to the surface in the area of the springs and seeps. ORNI 32 exploration and testing to date has not identified any barrier effects along fault features.

Huntington et al. (2014) report that most basin-fill groundwater sampled throughout Dixie Valley generally contains between 10 and 12 percent geothermal water, highlighting potential mixing between basin-fill and geothermal aquifer waters (geothermal aquifer waters are described in more detail below).

Four shallow wells in the central part of Dixie Valley near the lease area (on the playa), ranging in depth from 10 to 50 feet and in diameter from 1 to 2 inches, were monitored for water levels by the USGS (Nevada State Wells 109435, 109491, 108770, and 108771; USGS 2016). Depth-to-water measurements in these wells ranged from approximately 0.5 to 14 feet below ground surface. Groundwater quality samples collected in November 2009 and May 2010 for two of the USGS wells (109491 and 109435; USGS 2016) showed the following characteristics:

- TDS = 173,000 to 184,000 mg/L
- Specific conductance = 133,000 to 162,000 microsiemens per centimeter
- pH = 9.2 to 9.4 standard units
- Temperature = 64 to 72°F (18 to 22°C)
- Hardness = 13 to 16 mg/L
- Alkalinity = 15,800 to 18,400 mg/L
- Calcium = 3.6 to 4.3 mg/L
- Magnesium = 1.2 to 1.4 mg/L
- Sodium = 67,500 to 92,800 mg/L
- Potassium = 174 to 325 mg/L
- Chloride = 107,000 to 146,000 mg/L
- Bromide = 104 to 122 mg/L
- Sulfate = 3,990 to 14,800 mg/L
- Nitrate plus nitrite = 16.0 to 17.3 mg/L
- Silica = 8.4 to 34.8 mg/L

ORNI 32 has also conducted groundwater sampling in the project area as identified in the Dixie Meadows Water Resources Monitoring Plan (Ormat 2011). Prior to drilling well 42(12)-9, ORNI 32 installed and sampled monitoring well MW-1 in the lease area northeast of well 42(12)-9, near the northeast corner of the western playa pond. The well was drilled to a depth of 472 feet. Mostly high-plasticity gray and blue clay was encountered to a depth of 327 feet, which was underlain by more clay with intervals of coarse sand to the total depth. Sampling for flow, temperature, and water quality was collected in July 2011 (no water quality data were collected at this date), May 2012, and September 2016. In July 2011, an artesian flow rate of 3 to 4 gpm at a temperature of 84°F was reported. Ormat retested the well in May 2012 and observed an initial flow rate of 25 gpm, which decreased to 20 gpm after 20 minutes at a temperature of 72.9°F (Ormat 2012). In September 2016, an initial flow rate of 25 gpm at 64.1°F was observed, which decreased to 16 gpm after 30 to 40 minutes at a temperature of 73.2°F (Ormat 2016). Sampling confirmed that the groundwater does not meet drinking water standards for several parameters. Sampling results for monitoring well MW-1 for May 2012 and September 2016 are summarized in **Table 10**, below (Ormat 2012; 2016).

Table 10
Monitoring Well MW-1 Sampling Results; May 2012 and September 2016

Monitoring Parameter	Result[1] (2012)	Result[1] (2016)
Free cyanide	ND	No data reported
Ammonia, as nitrogen	0.66	No data reported
pH	8.08	8.24
Total suspended solids	ND	2
Bicarbonate (HCO_3)	160	130
Carbonate (CO_3)	ND	ND
Hydroxide (OH)	ND	ND
Total alkalinity (as $CaCO_3$)	130	130
Orthophosphate	0.027	No data reported
Chloride	1,600	1,600
Fluoride	8.8	6.2
Sulfate	220	170
Nitrate nitrogen	ND	ND
Nitrite nitrogen	ND	No data reported
Total dissolved solids	2,900	3,100
Electrical conductivity	5,800	4,100
Aluminum	0.19	0.085
Barium	0.042	0.045
Beryllium	ND	ND
Boron	No data reported	1.7
Cadmium	ND	ND
Calcium	No data reported	27
Chromium	ND	ND
Copper	ND	ND
Iron	0.57	0.25
Lithium	No data reported	0.483
Magnesium	2.1	2.2
Manganese	0.098	0.082
Molybdenum	ND	ND
Nickel	ND	ND
Potassium	No data reported	7.1
Silica	No data reported	41
Silver	ND	ND
Sodium	1,200	1,300
Zinc	ND	ND
Mercury	0.0016	ND
Antimony	ND	ND
Arsenic	0.011	0.014
Lead	ND	ND
Selenium	ND	0.0056
Thallium	ND	ND

Sources: Ormat 2012; 2016
[1] All results are in mg/L, except for pH (standard units) and electrical conductivity (microsiemens per centimeter)
ND = Not detected (less than reporting limit)
No data reported = sample parameter data not reported

Some constituents in groundwater samples collected from Dixie Valley exceeded established drinking-water quality criteria (Huntington et al. 2014).

Primary drinking water standards were exceeded for arsenic (0.01 mg/L; 41 of 64 sites) and fluoride (4 mg/L; 17 of 45 sites). Secondary drinking water standards were exceeded for total dissolved solids (500 mg/L; 35 of 65 sites) and manganese (0.05 mg/L; 15 of 62 sites).

The Dixie Meadows Water Resources Monitoring Plan (Ormat 2011) identified three proposed new monitoring wells: MW-1 (T22N, R35E, Section 9), MW-2 (T22N, R35E, Section 17), and MW-3 (T22N, R35E, Section 20). Flow rate or static water level, temperature, EC, pH, and selected analytes (for water quality analysis) were to be collected for the proposed new monitoring wells. Drilling of the first monitoring well (monitoring well MW-1) was completed in July 2011. Monitoring wells MW-2 and MW-3 were to be completed prior to the construction of the second exploration test well; however, they have not been drilled.

Groundwater monitoring was to occur quarterly for the first 2 years. After the first 2 years, groundwater monitoring was to occur semiannually. ORNI 32 did not collect required groundwater monitoring data as outlined in the Dixie Meadows Water Resources Monitoring Plan (Ormat 2011) from October 2011 to September 2016; monitoring data were collected once in 2011, 2012, and 2016.

As discussed above in *Surface Water*, McGinley & Associates (2018-2020) has monitored locations USGS-101, NDOWSS1, USGS-301, and monitoring well MW-1 quarterly since August 2018, and has sampled and monitored other monitoring locations (see Figure 15 of the ARMMP; **Appendix H**) less frequently to further establish baseline conditions and inform the hydrogeologic conceptual model. Historical data at USGS-301 North, NDOWSS-1, the western playa pond, USGS-101, and Spring 2 were provided by Rubicon Environmental Consulting (Rubicon 2018). For each monitoring location, a summary of field parameters are presented in Table 6, and water chemistry results are presented in Table 7 of the ARMMP (**Appendix H**). Major ion concentrations indicate a sodium-potassium-chloride water type for all groundwater samples. This is indicative of geothermal mixing (EGS 2014a) and evaporite-rich playa water.

ORNI 32 has also monitored wells 23A-8 (in 2017) and 24-8 (in 2016). Water chemistry results are presented in Table 7 of the ARMMP (**Appendix H**). In summary, results show high temperatures and water chemistry indicative of geothermal influence.

Geothermal Resources

Dixie Valley is the hottest (temperatures over 545°F [285°C] at a 9,800-foot depth) and one of the largest geothermal systems in the Basin and Range Province (Blackwell et al. 2009). A considerable volume of research into the Dixie Valley geothermal area has been conducted to characterize and describe the area's geothermal resources (Benoit 1999; Blackwell et al. 2002; Blackwell et al. 2003; McKenna and Blackwell 2004; Blackwell et al. 2007; Blackwell et al. 2009). The region has been used as a field laboratory to develop and test geothermal exploration methods (Iovenitti et al. 2013). **Appendix L** is a detailed summary of Ormat's exploration activities in the Dixie Valley since 2011.

Geothermal groundwater resources with a wide range of temperatures are present beneath the basin-fill aquifer in Dixie Valley to estimated depths of 20,000 feet (Blackwell et al. 2003; Blackwell et al. 2009; McKenna and Blackwell 2004). The deep geothermal fluid is separated from the shallower groundwater by a confining sequence composed of thousands of feet of low-permeability, clay-altered volcaniclastic rocks and alluvium.

The Dixie Valley geothermal system occurs along the fault zone bounding the Dixie Valley and the Stillwater Range on the western edge of the valley (Blackwell et al. 2007). The Dixie Meadows is in the southern portion of this nearly 20-mile-long system. In this area, geothermal groundwater resources locally occur in fractured zones within the bedrock underlying the basin-fill deposits (Blackwell et al. 2003; Blackwell et al. 2009; McKenna and Blackwell 2004).

Waibel (1987), Blackwell et al. (2007), and others report geochemical evidence suggesting an apparent direct connection between hot springs and the deeper geothermal resource, whereby some geothermal waters travel via Piedmont Faults directly into Dixie Valley alluvial fill where they mix with shallow groundwater in the unconfined basin-fill aquifers. In some cases, geothermal groundwater migrates upward along permeable structures, discharges into basin-fill sediments, and flows toward the center of the basin in the shallow subsurface (EGS 2014a). In some cases, small amounts of geothermal water escape to the surface through hot springs and steam vents. Most springs in the valley exhibit evidence of shallow groundwater mixing with thermal water before discharging at the ground surface.

To contrast the geothermal and shallower basin-fill aquifers, Huntington et al. (2014) compared selected geothermal data published in Goff et al. (2002) and the Great Basin Center for Geothermal Energy (2009) with collected basin-fill groundwater samples. Samples were collected throughout the Dixie Valley Hydrographic Area (NDWR Basin 128). Several methods of chemical comparisons between basin-fill and geothermal aquifer water indicate that most basin-fill groundwater sampled generally contains 10 to 12 percent geothermal water—a range similar to that of previous findings (Bruton et al. 1997). These results indicate some mixing between the basin-fill and geothermal water aquifers (Huntington et al. 2014).

Similarly, stable isotopes of oxygen-18 and deuterium, and geothermal indicators such as high temperature, lithium, boron, chloride, and silica indicate that geothermal resource mixing occurs in wells that tap the basin-fill aquifer, particularly on the north, south, and west sides of the Dixie Valley groundwater basin (Huntington et al. 2014). The main chemical indicators of geothermal water in Dixie Valley identified by Huntington et al. (2014) are high concentrations of lithium, boron, and silica.

Permeability or upwelling of the geothermal system appears to depend on the opportunity for vertical water movement within the Dixie Valley Fault and other minor faults at the foot of the Stillwater Range. Conversely, geothermal water entering this fault system deposits silica (Hickman et al. 1997), and permeability would eventually be sealed off by silica precipitation if not for periodic movement of the fault (Zoback 2007). Upwelling continues until the heated water reaches the ground surface (BLM 2011).

The existing Terra-Gen Dixie Valley Geothermal Facility located approximately 16 miles north of the lease area provides an opportunity to compare geothermal water attributes with basin-fill water aquifer attributes; this comparison is shown in **Table 11**, below. Based on generally similar geologic and hydrogeologic conditions, the water quality differences between the two aquifers at the Terra-Gen Dixie Valley Geothermal Facility are anticipated to be similar to those exhibited in the proposed lease area.

Table 11
Comparison of Geothermal and Non-Geothermal Groundwater Quality Near the Terra-Gen Dixie Valley Geothermal Facility

Ion Pairs	Geothermal Water Typical Range (meq/liter[1])	Non-geothermal Water Typical Range (meq/liter[1])
Sodium + potassium	90 to >95 percent	20 to 80 percent
Calcium + magnesium	<5 to 10 percent	20 to 80 percent
Chloride + sulfate	25 to 90 percent	25 to 85 percent
Bicarbonate + carbonate	5 to 75 percent	5 to 75 percent

Source: Nimz et al. 1999

[1] meq/L = milliequivalents per liter, or milligrams per liter divided by the combining weights of the indicated ions.

Conceptual Hydrogeologic Model

Appendix D of the ARMMP (**Appendix H**) is a conceptual hydrogeologic model of the project area that was developed based on available data obtained from field research, information assimilated during a literature review, and generally accepted principles of groundwater and surface water flow in the Basin and Range Province.

The conceptual hydrogeologic model indicates the presence of two main aquifers in the Dixie Meadows area: a shallow, unconsolidated alluvial aquifer and a deeper aquifer consisting of consolidated and chemically altered alluvium and bedrock. High-temperature geothermal fluid has an origin in the deep bedrock aquifer. Hydrologic, geochemical, and geophysical data indicate that some of the geothermal fluid migrates upward through east-northeast-trending fault structures discharging out into the shallow, unconsolidated alluvial basin-fill. The mixed groundwater then moves laterally through basin-fill deposits toward the Dixie Valley playa and discharges as springs along fault discontinuities in the alluvium. The degree of geothermal mixing appears to increase with increasing spring temperature. The majority of this water is then lost to evapotranspiration and evaporation.

Temperature, chemistry, and isotope data suggest that spring discharge within Dixie Meadows consists of a mixture of modern recharge water from precipitation, and geothermal water. The western and eastern ponds fill with a mixture of spring discharge from Spring Complex 2 (see Figure 15 in **Appendix H**), mixed occasionally with runoff from storm events. The persistent source of water to the ponds is spring discharge that is not consumed by meadow vegetation in the winter. The ponds are ephemeral and exhibit dry conditions each summer.

Water Source Chemical Characterization

Temperature

Water temperature is one indicator of potential geothermal input at seeps and springs. A summary of historical water temperatures at existing monitoring locations is presented in Table 6 of the ARMMP (**Appendix H**). Springs with the highest water temperatures in Dixie Meadows are within Spring Complex 2, indicating significant geothermal input in this area. Overall, water temperature decreases to the north, east, and south of this location (**Appendix H**, Figures D8 and D9).

Chemistry

Results of previous water geochemistry studies in Dixie Valley (EGS 2014a; Huntington et al. 2014; Benoit 2011) suggest that multiple geothermal systems exist in Dixie Valley and that each system is geochemically unique with groundwater chemistry evolving along distinct flow paths with varying rock types. A summary of water chemistry data for samples collected in Dixie Meadows since August 2018 is provided in Table 7 and Appendix D of the ARMMP (**Appendix H**). Relatively constant ratios of conservative chemical elements and ionic compounds, such as boron-to-chloride and lithium-to-chloride, in the spring samples collected in Dixie Meadows suggest that the fluids are derived from a common regional geothermal resource and that they interact with similar lithologies along their flow paths.

Concentrations of silica and magnesium, and water temperature, are key indicators of geothermal fluid and can be used to determine the degree of mixing between geothermal and other water sources, including meteoric and basin-fill groundwater.

Lithium concentrations have been useful in determining geothermal-freshwater mixing ratios at other geothermal sites; however, elevated lithium concentrations in Dixie Meadows may result from mixing with geothermal waters or evaporite-rich waters from playa deposits.

Hot spring water in the study area is represented by low magnesium-to-lithium molar ratios and high silica concentrations, while cooler waters have higher magnesium-to-lithium molar ratios and lower silica concentrations (see Table 7 and Appendix D in the ARMMP; **Appendix H**).

Water Rights

The perennial yield of the Dixie Valley Hydrographic Area (Hydrographic Area 128, Hydrographic Region 10) is estimated to be 15,000 acre-feet/year (NDWR 2019; Cohen and Everett 1963). The NDWR has determined that current groundwater appropriations (November 2020) total 15,218.28 acre-feet/year, as differentiated by manner of use, as summarized below:

- 5,856 acre-feet/year for industrial uses (geothermal energy production)
- 8,770 acre-feet/year for irrigation uses
- 218 acre-feet/year for quasi-municipal uses
- 112 acre-feet/year for stockwater uses
- 262 acre-feet/year for wildlife uses

Groundwater pumping within Dixie Valley in 2015 totaled 16,906 acre-feet (NDWR 2016b); it was distributed as follows:

- 5,856 acre-feet/year for industrial use (geothermal energy production)
- 8,770 acre-feet/year for irrigation
- 218 acre-feet/year for quasi-municipal
- 112 acre-feet/year for stockwater
- 262 acre-feet/year for wildlife

Geothermal groundwater appropriations are categorized separately than the appropriations listed above. This is because geothermal appropriations are nonconsumptive where the pumped geothermal groundwater is returned to the aquifer. Total geothermal water rights appropriated in Dixie Valley are 12,704 acre-feet/year (NDWR 2019).

There are active water rights within and adjacent to the project area. An inventory of active water rights throughout Dixie Valley is presented as Table 1 of the ARMMP.

Specifically in the Dixie Meadows area, there are four vested claims[18] on springs that are held by the current livestock grazing permittee for stockwatering; each has a diversion rate of 2.5 gpm (NDWR 2016a). These claims are on springs in the vicinity of the Dixie Hot Springs and warm and cold springs nearby (all are in T22 North, R35 East), as follows:

- V10057—Dixie Meadows Hot Spring (southwest quarter of the southeast quarter, Section 5, T22 North, R35 East)
- V10058—Dixie Corral Spring (ID#2192; associated with USGS S25; northeast quarter of the southwest quarter, Section 4, T22 North, R35 East)
- V10065—Dixie Meadows Cold Spring (ID#2208; associated with USGS S23; southwest quarter of the northwest quarter, Section 17, T22 North, R35 East)
- V10066—Dixie Meadows Seep (designated as an Other Surface Water source rather than a Spring source) (ID#2210; northwest quarter of the northeast quarter, Section 19, T22 North, R35 East)

In addition to the four vested rights listed, there are two active applications (ready for action, but no permit granted) held by Churchill County for municipal and quasi-municipal use in Township 22 North, Range 35 East:

- 49800—Southwest quarter of the southwest quarter, Section 4, T22 North, R35 East; quasi-municipal; underground
- 79627—Southwest quarter of the southeast quarter, Section 5, T22 North, R35 East; municipal; underground

Within the wider hydrographic area, rights are used for the following purposes (NDWR 2016a): commercial, domestic, industrial, irrigation (Carey Act), irrigation, (desert-land entry), irrigation, mining and milling, municipal, other, power, quasi-municipal, stockwatering, and wildlife.

Jurisdictional Waters

The Clean Water Act, as amended in 1977, established the basic framework for regulating discharges of pollutants into the waters of the United States, including wetlands. The US Army Corps of Engineers (USACE) regulates the discharge of dredged and fill material into waters of the United States, including wetlands, in accordance with Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899.

The USACE defines wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and

[18] Vested claims are for water rights that pre-date the 1905 Nevada water law statutes.

that under normal circumstances, do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328.3(c)(16)).

Federal jurisdiction over a non-wetland water of the United States extends to the ordinary high water mark. The ordinary high water mark is "that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas" (33 CFR 328.3(c)(7)).

Dixie Valley is an internally drained basin; that is, surface flows terminate in the basin rather than escaping the basin and flowing west to the Pacific Ocean (USACE 2002). In a report prepared by the USGS, Dixie Valley is described as a closed hydrologic unit (Cohen and Everett 1963). These descriptions are indicative that the basin lacks any hydrologic connectivity to rivers or other waterbodies outside the basin. There are no approved jurisdictional determinations that have been completed in the project area. The surface water resources in Dixie Meadows appear to be isolated from any waters of the US (as defined in 40 CFR 230.3); therefore, there appear to be no jurisdictional waters within the project area.

The Humboldt Salt Marsh, a playa, is subject to inundation from seasonal runoff associated with snowmelt in surrounding mountain ranges during winter (Bryce et al. 2003). The USACE does not appear to have jurisdiction over the Humboldt Salt Marsh, which does not abut and has no surface connection to waters of the US.

3.3.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)

The project could affect water resources in three primary ways: 1) it could degrade the surface water quality by increasing erosion and sedimentation, or altering spring-discharged water chemistry; 2) it could alter water quantity by reducing spring discharge rates, decreasing groundwater supply, or interfering with groundwater recharge; or 3) it could alter surface or geothermal water temperatures. Extensive spring and seep, groundwater, and geothermal resource monitoring, as described in Sections 3.1 and 3.2 of the ARMMP (**Appendix H**), would allow for early detection of potential changes to groundwater and surface water quality, quantity, and temperature. If monitoring detects potential adverse effects, the mitigation measures described in Section 3.9.1 of the ARMMP (**Appendix H**) would be implemented.

Water Quality

The deep, high-temperature, bedrock-hosted geothermal aquifers, at depths of 3,000 to 5,000 feet, would be used for geothermal power production. During project construction or utilization, the mixing of geothermal waters with the shallow groundwater aquifer could alter the water quality, including temperature, in surface water features (springs, seeps, and streams) within the Dixie Meadows. Casing geothermal production and injection wells with steel to a depth well below the shallow groundwater reservoirs in the alluvial fill basins would prevent mixing of the shallow basin-fill groundwater and geothermal reservoirs. The casing would be cemented into the ground to prevent the loss of any geothermal resource into, and prevent the contamination or mixing of, any shallow groundwater by the geothermal production or injection fluid. Further, implementing adaptive management and/or mitigation measures described in Section 3.9 of the ARMMP (**Appendix H**), in response to any detections of mixing based on geothermal and groundwater well and surface water monitoring (Sections 3.1 and 3.2 of the ARMMP; **Appendix H**), would also avoid, minimize, or mitigate future impacts.

The UIC Permit required for the project's injection program from the NDEP Bureau of Water Pollution Control would require that the injection program be designed and monitored to prevent degradation of underground sources of drinking water due to the geothermal fluid injection practices. This requirement would avoid potential impacts on surface or shallow groundwater quality from injection.

Reserve pits would be constructed at each well pad to contain and temporarily store drilling mud, drill cuttings, stormwater runoff, and the geothermal fluid produced during well testing. Because nontoxic drilling mud would be used, the reserve pits are not proposed to be lined. Additionally, the bentonite drilling muds discharged into the reserve pits would tend to act as a liner, in the same way they prevent the loss of drilling fluids in the well bore into the surrounding rock. Therefore, changes in the water quality of the shallow groundwater aquifer from temporary drilling discharges into the reserve pits are unlikely.

Over the operational life of the project, accidental discharges of geothermal fluids are unlikely because of the frequent inspections and ultrasonic testing of the geothermal pipelines, the pipeline flow and pressure monitoring, and the well pump and pipeline valve shutdown features. Should any geothermal fluids be accidentally discharged from pipelines carrying geothermal fluids, ORNI 32 would implement its discharge contingency plan (**Appendix J**, **Section J.4.1**). ORNI 32 would temporarily suspend operations and notify the BLM. ORNI 32 would implement the appropriate mitigation measures as directed by the BLM in accordance with the spill or discharge contingency plan, such as spill cleanup, notification, and steps to take to prevent another spill. ORNI 32, in coordination with the BLM and partner agencies, with prior approval by the BLM Authorized Officer, may also need to temporarily amend the ARMMP (**Appendix H**) following a spill to account for altered soil and water quality conditions.

Similarly, contamination of surface water or groundwater from spills of petroleum products (such as diesel fuel or lubricants) could occur. Implementing the environmental compliance and protection measures described in **Section J.1.2** of **Appendix J** and Section 4 of ORNI 32's Utilization Plan (Ormat 2021) would avoid these impacts. Constructing berms around the well pads and power plant sites, where most petroleum products would be used and stored, would contain and control any accidental spills. As described in **Section 3.17**, Public Health and Safety and Hazardous Materials, any spill of hazardous waste or hydrocarbons would be remediated by following all local, state, and federal regulations. ORNI 32 would comply with EPMs in **Appendix J**, including the spill or discharge contingency plan (**Section J.4.1** of **Appendix J**). These construction best practices and EPMs would reduce the potential for spill-related impacts on water quality by containing spills and ensuring cleanup would occur in a more expedited manner should a spill occur.

As described in **Section 3.2**, Air Quality, there is the potential for binary geothermal power plants to leak binary fluid (butane). While most leaked butane would likely vaporize into the atmosphere, there are examples (see, for instance, the Casa Diablo geothermal facility near Mammoth Lakes, California, as referenced in Bergfield and Evans 2011) where some may make its way into the reinjected geothermal fluids. Monitoring surface expressions in accordance with the ARMMP (**Appendix H**) would identify any changes in water quality. ORNI 32, in consultation with the BLM Authorized Officer, would apply mitigation measures, as needed, to avoid, minimize, or mitigate any water quality impacts.

The proposed power plant(s), substations, well pads, access roads, and gen-tie would result in surface disturbance, which could increase erosion and sedimentation to springs downslope and inhibit groundwater infiltration and recharge rates. Locating project features outside of springs and wetlands would avoid disturbance in those areas and minimize potential water quality impacts from erosion and sedimentation. Constructing the gen-tie along the existing county road would avoid disturbance in wetlands from that component of the proposed project. Further, BLM-required stormwater BMPs, such as ditches or swales, would prevent stormwater runoff from undisturbed areas entering disturbed areas associated with well pads, power plant sites, and substations. Access roads would also be constructed and maintained consistent with the BLM BMPs for road construction applicable to the intended use (temporary or permanent) of the road. These stormwater and road construction BMPs would avoid or minimize erosion and associated water quality impacts from the disturbed areas.

Water Quantity and Water Rights

Changes in thermal feature surface expressions can accompany geothermal development (Sorey 2000). Changes such as declines in thermal-water discharge, increases in fumarolic steam discharge, and surface subsidence have been documented, including geothermal developments in Dixie Valley (Benoit

1997; Bergfeld et al.1998). Consuming geothermal fluid during operation decreases the discharge rate and associated geothermal reservoir pressures. In situations where the groundwater aquifer is hydrologically connected to the geothermal reservoir, decreased geothermal reservoir pressure can alter water quantity in connected surface water features by reducing spring flows or water levels. Operating the proposed air-cooled geothermal plants is not anticipated to consume geothermal water resources; this is because all geothermal fluid used in production would be reinjected back into the geothermal reservoir. Injecting water from the basin-fill aquifer into the geothermal reservoir would maintain suitable production pressures (Benoit et al. 2000). This would also avoid water quantity impacts in springs or overlying groundwater aquifers.

Geothermal reservoir testing described in **Appendix L** and flow testing described in **Appendix M** has not identified that the Dixie Valley or Piedmont Faults contribute to significant geothermal fluid flow. Rather, lateral shallow thermal flow from upwelling to the west of the Dixie Meadows along the cross-cutting east-northeasterly faults, as shown in the conceptual model depicted in Figure 5 of the ARMMP and described in Appendix D of the ARMMP (**Appendix H**), are thought to be the primary water source for the warm and hot springs along the western side of Dixie Meadows. It is possible that vertical upflow along the Piedmont Fault is also a water source for the springs; however, evidence (EGS 2014a) and recent testing of the geothermal reservoir (**Appendix L**) do not support it.

Implementing the adaptive management and/or mitigation measures described in Section 3.9 of the ARMMP (**Appendix H**) in response to any detections of potential changes to water quantity of springs and seeps, and groundwater aquifers based on extensive geothermal, groundwater well, and surface water (springs and seeps) monitoring, as described in Sections 3.1 and 3.2 of the ARMMP (**Appendix H**), would avoid, minimize, or mitigate any adverse impacts on surface water resources.

In order to preserve the natural environment of Dixie Meadows, including warm spring discharges and the seasonal playa ponds, a carefully implemented production and injection program would be developed to maintain the water balance of the springs and the shallow aquifer system. Additional exploration drilling and flow/injection tests are anticipated in the project area; as such, the production and injection program would be developed and refined upon completion of these activities and collection of additional data. Theoretically, no water would be consumed by the project as the facility would use air-cooled, binary technology; therefore, the total water balance for the system would be preserved. This is because geothermal production flow would equal injection return to the hydrologic system.

Discharging geothermal fluid to the reserve pits during initial well testing could have the same effects on water quality as described above. However, the volume of fluid withdrawn during well tests would be a small fraction of the total volume of fluid naturally available in the geothermal resource. Removing geothermal fluid during well testing would result in a negligible change to the quantity of surface water expressions at springs in the project area. Any minor changes would be further mitigated through the implementation of the mitigation measures described in Section 3.9 of the ARMMP (**Appendix H**). The need for any mitigation measures would be in response to pumping tests, flow tests, injection tests, tracer tests, and other applicable site-specific spring and seep monitoring that would occur during well testing, and aid in detection of potential changes or impacts on water quantity or temperature, as described in Section 3.2 of the ARMMP (**Appendix H**).

Groundwater consumption, such as extracting groundwater from the basin for construction, could temporarily impact groundwater quantity and decrease surface expression at basin springs. There would be little potential for these types of impacts because the 17.6 acre-feet for 1 year of construction would be obtained from a private source outside the hydrographic basin and trucked to the site. The 2.5 to 3.0 acre-feet/year for operation is a fraction of the overall aquifer perennial yield of 15,000 acre-feet (NDWR 2016b). Monitoring surface expressions, in accordance with the ARMMP (**Appendix H**), would identify water quantity changes. ORNI 32, in consultation with the BLM Authorized Officer and ARMMP partner agencies, would apply developed mitigation measures, as needed, to reduce observed adverse impacts on water quantity.

If the quantity of surface water discharge were affected by constructing or operating the geothermal plants, vested and other water rights on nearby springs could be indirectly impacted. Adverse impacts could occur if spring flow were reduced or stopped, which would result in permittees being unable to fulfill their water rights' intended beneficial use, such as watering stock or irrigating crops. Implementing groundwater well and surface water (springs and seeps) monitoring, as described in Sections 3.1 and 3.2 of the ARMMP (**Appendix H**), would allow for detection of any potential changes to the water quantity of springs and seeps, and groundwater aquifers. The subsequent implementation of the mitigation measures described in Section 3.9 of the ARMMP (**Appendix H**) would avoid, minimize, or reverse those impacts.

When monitoring water quantity and implementing adaptive management and mitigation measures, such as halting groundwater withdrawals, there is the potential for a time lag between detectable and maximum effects in surface expression, resulting in maximum impacts that are larger than those observed even after withdrawal is halted. Once halted, the recovery to the pre-pumping state may occur slowly (Bredehoeff and Durbin 2009). Monitoring and mitigation measures would minimize, but may not completely avoid, long-term effects on the water quantity in the system.

Water Temperature
Reinjecting fluid with a lower post-production temperature or discharging geothermal fluids to the surface during flow testing (see **Section 2.1.2**) could affect the temperature or flow rate of springs and groundwater aquifers that are hydrologically connected to the geothermal aquifer. Any reduction in the temperature of the geothermal component of a hydrologically connected thermal spring could cool the thermal spring, including one with present-day temperatures less than the anticipated temperature of the proposed cooled geothermal injection (150 to 170°F).

The results of recent groundwater monitoring following flow and injection well testing conducted on 2017 (see **Appendix M**) did not indicate significant variances in temperature outside of what appears to be normal variations recorded before and after testing (see Figures H9 to H11 in Appendix D of the ARMMP). This indicates there were no apparent influences of pumping and injection activities observed at Springs 5A and 5B, which would be directly east of several proposed production or injection wells (see **Figure 3**, above, and Figure 14 of the ARMMP in **Appendix H**).

The following mitigation measures described in Section 3 of the ARMMP (**Appendix H**) would avoid, minimize, or reverse potential impacts: (1) providing geothermal fluids to the affected hot springs of a quality and quantity sufficient to restore pre-production temperature, flow/stage, and basic thermal chemistry; (2) adjusting the geothermal reservoir pressure regime, including modifying the volume/pressure of produced and/or injected geothermal fluid; (3) relocating one or more injection wells; (4) modifying geothermal fluid pumping and/or injection rates; (5) altering pumping and/or injection well locations; and (6) temporarily ceasing pumping and/or injection at site-specific well locations. Additional mitigation measures developed in accordance with the ARMMP—or as directed by the BLM pursuant to the lease stipulations, which could include shutting down the operation (see EPMs in **Appendix J**)—would further avoid the potential for water temperature changes.

Alternative 1 (Southern Gen-tie Route)
Impacts on water quantity and temperature would be the same as those under the Proposed Action. Impacts on water quality would also be the same as those under the Proposed Action, with the exception that there would be no potential for erosion or sedimentation along the southern gen-tie ROW; this is because there are no springs or seeps in that area.

The southern gen-tie ROW crosses several ephemeral drainages that may flow into or near the cold springs and seeps in the southern portion of the Dixie Meadows area (T22N, R35E, Sections 18 and 19). These features are between 1,700 and 2,100 feet from the southern gen-tie alignment. However, because these springs are believed to be fed by groundwater, as opposed to surface recharge from ephemeral drainages, disturbance associated with Alternative 1 would not affect the springs' water quantity or temperature. Construction access would use existing routes to the extent possible, which would avoid or minimize water quality impacts associated with erosion and sedimentation from ROW construction. Where access is necessary and no reasonable access roads exist, ORNI 32 would use overland travel to access the ROW. Surface grading or vegetation clearing for gen-tie construction would occur only when absolutely necessary for safe access or for installing the conductors; it would occur only within the proposed ROW (ORNI 32 2020). Any surface disturbance would comply with BLM BMPs. These construction best practices would avoid or minimize erosion and the associated water quality impacts.

Potential impacts on geothermal resources and water rights under Alternative 1 would be the same as described under the Proposed Action.

Water resources-specific mitigation measures listed in **Appendix J**, **Section J.2.2** would be the same as described under the Proposed Action.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the Proposed Action, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. As such, there would be no change in existing water resources conditions at the site. Compared with the Proposed Action, suspending exploration activities would result in less data about the geothermal resource at Dixie Meadows.

3.4 Soil Resources

3.4.1 Affected Environment

The project area, including the gen-tie corridors for the Proposed Action and Alternative 1, overlaps 29 soil map units. **Table 12**, Gen-Tie Soil Map Units (Miles), lists the length of the northern and southern gen-tie alignments covered by each soil map unit. Soils in the project area are depicted on **Figures 8-1**, **8-2**, and **8-3**).

As shown in **Table 12**, the three soil map units underlying the greatest length of the gen-tie alignments are the Slaw-Trocken-Chuckles association, Bluewing-Pineval association, and Mazuma very fine sandy loam, 0 to 4 percent slopes unit. The Pelic-Turupah complex, 0 to 1 percent slopes, are hydric soils that underlie most wetland and riparian areas in Dixie Meadows; these soils comprise approximately 1 percent of soils in the Proposed Action area but are included in this analysis due to their uniqueness in the project area.

The candidate power plant locations are located entirely within the Bluewing-Pineval association. Most well pads are also in the Bluewing-Pineval association; the southernmost two pads are in the Slaw-Trocken-Chuckles association.

Table 12
Gen-Tie Soil Map Units (Miles)

Soil Map Unit (Key Number)	Proposed Action (miles) (Percent Total)	Alternative 1 (miles) (Percent Total)	Landscape Position Percent Slope	Surface Texture	Wind Erosion Hazard[1]	Water Erosion Hazard[2]
Appian-Juva-Bango association (476513)	0	1.8 (6%)	Bolsons,[3] lake terraces, drainageways 0 to 2%	Loam	5	Slight
Bluewing-Inmo association (476468)	0	1.3 (4%)	Inset fans and fan piedmonts[4] 2 to 8%	Very cobbly loam	7	Slight
Bluewing-Pineval association (476471)	7.9 (17%)	3.0 (10%)	Fan piedmonts, drainageways, inset fans 4 to 8%	Very gravelly loamy sand	3	Slight
Bango-Stumble association (476499)	0	1.7 (6%)	Lake terraces, bolsons, sand sheets 0 to 4%	Sandy loam	3	Slight
Chuckles-Bango association (476572)	0	3.4 (11%)	Bolsons, lake terraces 0 to 2%	Loam	5	Slight
Genegraf-Rednik-Trocken association (476426)	0	2.9 (10%)	Fan remnants, fan piedmonts 2 to 15%	Gravelly fine sandy loam	5	Slight
Hessing-Dun Glen-Bango association (476594)	1.3 (3%)	0	Fan piedmonts, fan skirts 2 to 4%	Silt loam	5	Slight
Hessing-Wholan-Dun Glen association (476593)	0.5 (1%)	0	Fan piedmonts, fan skirts 0 to 4%	Silt loam	5	Slight
Jerval-Chilper-Bluewing association (475203)	0.9 (2%)		Fan piedmonts, fan remnants 2 to 8%	Loam	5	Slight

Soil Map Unit (Key Number)	Proposed Action (miles) (Percent Total)	Alternative 1 (miles) (Percent Total)	Landscape Position Percent Slope	Surface Texture	Wind Erosion Hazard[1]	Water Erosion Hazard[2]
Juva-Wholan-Stumble association (476591)	0	4.8 (16%)	Fan piedmonts, fan skirts 0 to 4%	Loam	5	Slight
Mazuma very fine sandy loam, 0 to 4 percent slopes (476639)	5.7 (12%)	0	Fan skirts, bolsons 0 to 4%	Very fine sandy loam	3	Slight
Mazuma-Yipor association (475345)	4.0 (9%)	0	Lake plains 0 to 2%	Very fine sandy loam	4	Slight
Misad-Golconda-Tenabo association (475302)	2.6 (6%)	0	Fan piedmonts, fan skirts, fan remnants 2 to 8%	Gravelly very fine sandy loam	5	Slight
Oxcorel-Whirlo-Trocken variant association (475296)	1.6 (3%)	0	Fan piedmonts, fan remnants, fan collars, inset fans 2 to 8%	Gravelly very fine sandy loam	5	Slight
Pelic-Turupah complex, 0 to 1 percent slopes (476696)	0.4 (1%)	0	Flood plains, delta plains 0 to 2%	Sand	8	Slight
Playas (476684)	0.2 (<1%)	0	No data	Silty clay	4	Not rated
Preble variant-Whirlo association (475242)	0.5 (1%)	0	Bolsons, alluvial flats, fan aprons 2 to 8%	Very fine sandy loam	3	Slight
Rednik-Trocken-Bluewing association (476531)	0	2.8 (9%)	Fan piedmonts, fan remnants, inset fans 4 to 8%	Very gravelly sandy loam	6	Slight
Rednik-Trocken-Genegraf association (476532)	0.6 (1%)	0.2 (<1%)	Fan remnants, fan piedmonts, beach terraces 2 to 8%	Very gravelly sandy loam	6	Slight

Soil Map Unit (Key Number)	Proposed Action (miles) (Percent Total)	Alternative 1 (miles) (Percent Total)	Landscape Position Percent Slope	Surface Texture	Wind Erosion Hazard[1]	Water Erosion Hazard[2]
Settlement-Louderback-Rustigate association (476546)	2.1 (5%)	0	Lake terraces, bolsons 0 to 2%	Silty clay	4	Slight
Slaw-Chuckles association (476549)	1.2 (3%)	0	Stream terraces, semi-bolsons, lake terraces 0 to 2%	Silt loam	5	Slight
Slaw-Juva-Wholan association (476548)	0	3.1 (10%)	Stream terraces, semi-bolsons, inset fans 0 to 2%	Silt loam	5	Slight
Slaw-Mazuma-Hessing association (476550)	1.9 (4%)	0	Stream terraces, semi-bolsons, lake terraces, beach plains 0 to 4%	Silt loam	5	Slight
Slaw-Trocken-Chuckles association (476551)	10.2 (22%)	4.5 (15%)	Stream terraces, semi-bolsons, inset fans, lake terraces 0 to 4%	Silt loam	5	Slight
Trocken-Bluewing association (476518)	0	1.8 (6%)	Fan piedmonts, alluvial fans, inset fans 2 to 8%	Gravelly loamy sand	2	Slight
Weso very fine sandy loam, 0 to 2 percent slopes (475289)	2.0 (4%)	0	Fan piedmonts, fan skirts 0 to 2%	Very fine sandy loam	3	Slight
Whirlo-Beoska-Oxcorel association (475249)	2.1 (5%)	0	Fan piedmonts, fan skirts, fan remnants 2 to 8%	Very gravelly loam	7	Slight

Soil Map Unit (Key Number)	Proposed Action (miles) (Percent Total)	Alternative 1 (miles) (Percent Total)	Landscape Position Percent Slope	Surface Texture	Wind Erosion Hazard[1]	Water Erosion Hazard[2]
Wholan very fine sandy loam, rarely flooded, 0 to 2 percent slopes (475169)	2.5 (5%)	0	Fan piedmonts, fan skirts 0 to 2%	Very fine sandy loam	3	Slight
Yipor silt loam, sandy substratum (475176)	0.1 (<1%)	0	Semi-bolsons, stream terraces 0 to 2%	Silt loam	4	Slight

Source: NRCS 2016; NRCS GIS 2016

[1] Wind erosion potential is classified on a scale between 1 and 8, with a rating of 1 for soils that are highly susceptible to wind erosion, and a rating of 8 for soils that are the least susceptible to wind erosion.
[2] The hazard is described as slight, moderate, severe, or very severe.
[3] A semiarid, flat-floored desert valley or depression, usually centered on a playa or salt pan and entirely surrounded by hills or mountains
[4] A landform created at the foot of a mountain or mountains by debris deposited by shifting streams

The soil series comprising these four map units are described in detail below.

Slaw-Trocken-Chuckles association

The Slaw series consists of very deep, well drained soils that formed in alluvium over lacustrine deposits derived from mixed rocks. Slaw soils are on alluvial flats, floodplains, basin floors, lake plains, floodplain playas, drainageways, and low stream terraces. Slopes are 0 to 4 percent.

The Trocken series consists of very deep, well drained soils that formed in alluvium derived from mixed rocks. Trocken soils are on alluvial fans, fan remnants, inset fans, fan skirts, longshore bars, barrier beaches, beach terraces, and lake terraces. Slopes are 0 to 30 percent.

The Chuckles series consists of very deep, moderately well drained soils that formed in alluvium derived from mixed rocks over lacustrine sediments. Chuckles soils are on lake plains, lake terraces, and lagoons. Slopes are 0 to 2 percent (NRCS 2016).

Bluewing-Pineval association

The Bluewing series consists of very deep, excessively drained soils that formed in alluvium derived from mixed rocks. Bluewing soils are on fan remnants, beach plains, alluvial fans, and inset fans. Slopes are 0 to 30 percent.

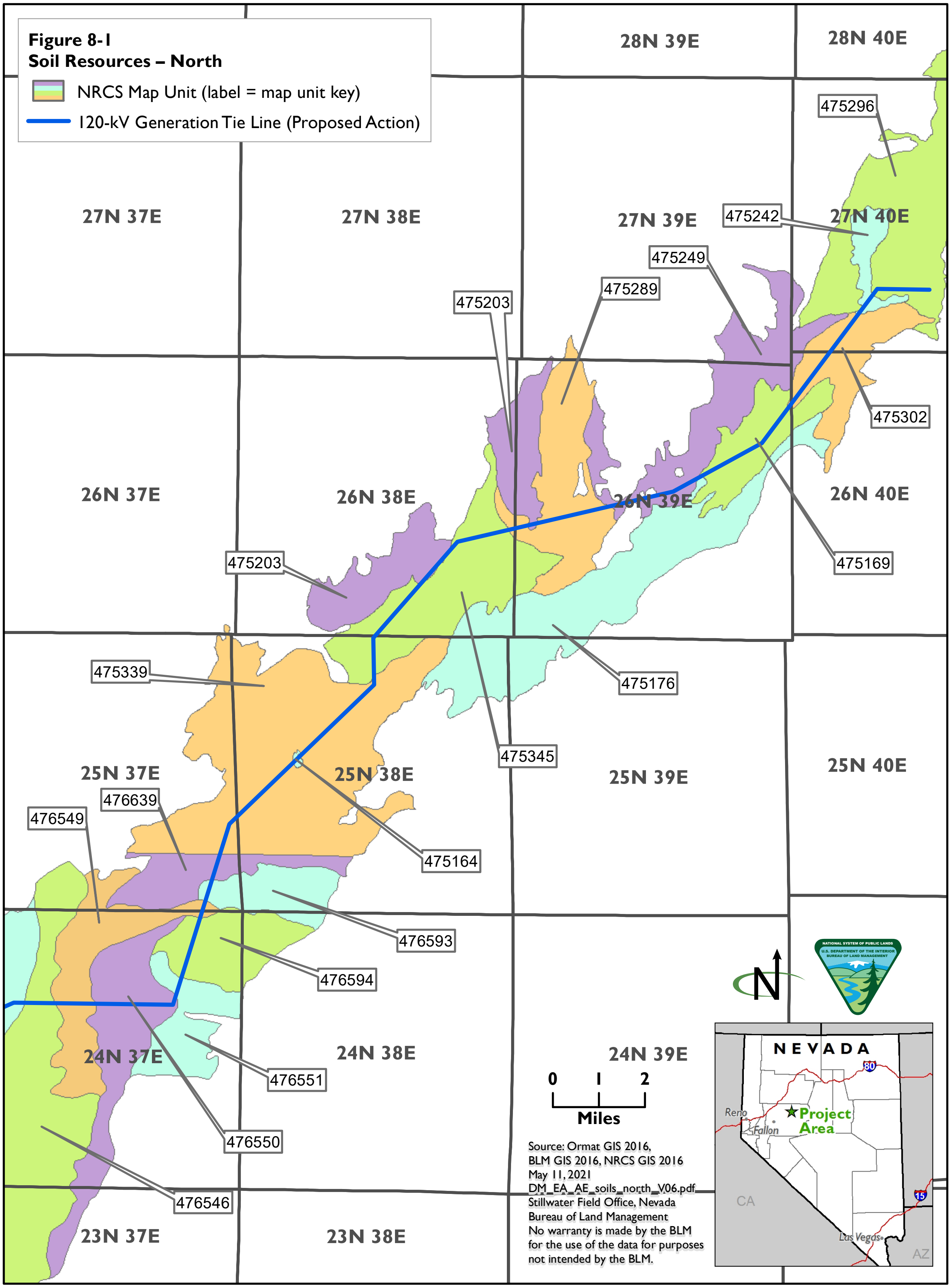

Figure 8-1
Soil Resources – North
NRCS Map Unit (label = map unit key)
120-kV Generation Tie Line (Proposed Action)
28N 39E
28N 40E
27N 37E
27N 38E
27N 39E
27N 40E
26N 37E
26N 38E
26N 39E
26N 40E
25N 37E
25N 38E
25N 39E
25N 40E
24N 37E
24N 38E
24N 39E
23N 37E
23N 38E
475296
475242
475249
475289
475203
475302
475169
475203
475176
475339
475345
476639
476549
475164
476593
476594
476551
476550
476546
0 1 2
Miles
Source: Ormat GIS 2016,
BLM GIS 2016, NRCS GIS 2016
May 11, 2021
DM_EA_AE_soils_north_V06.pdf
Stillwater Field Office, Nevada
Bureau of Land Management
No warranty is made by the BLM
for the use of the data for purposes
not intended by the BLM.
NEVADA
Reno
Fallon
Project Area
CA
Las Vegas
AZ

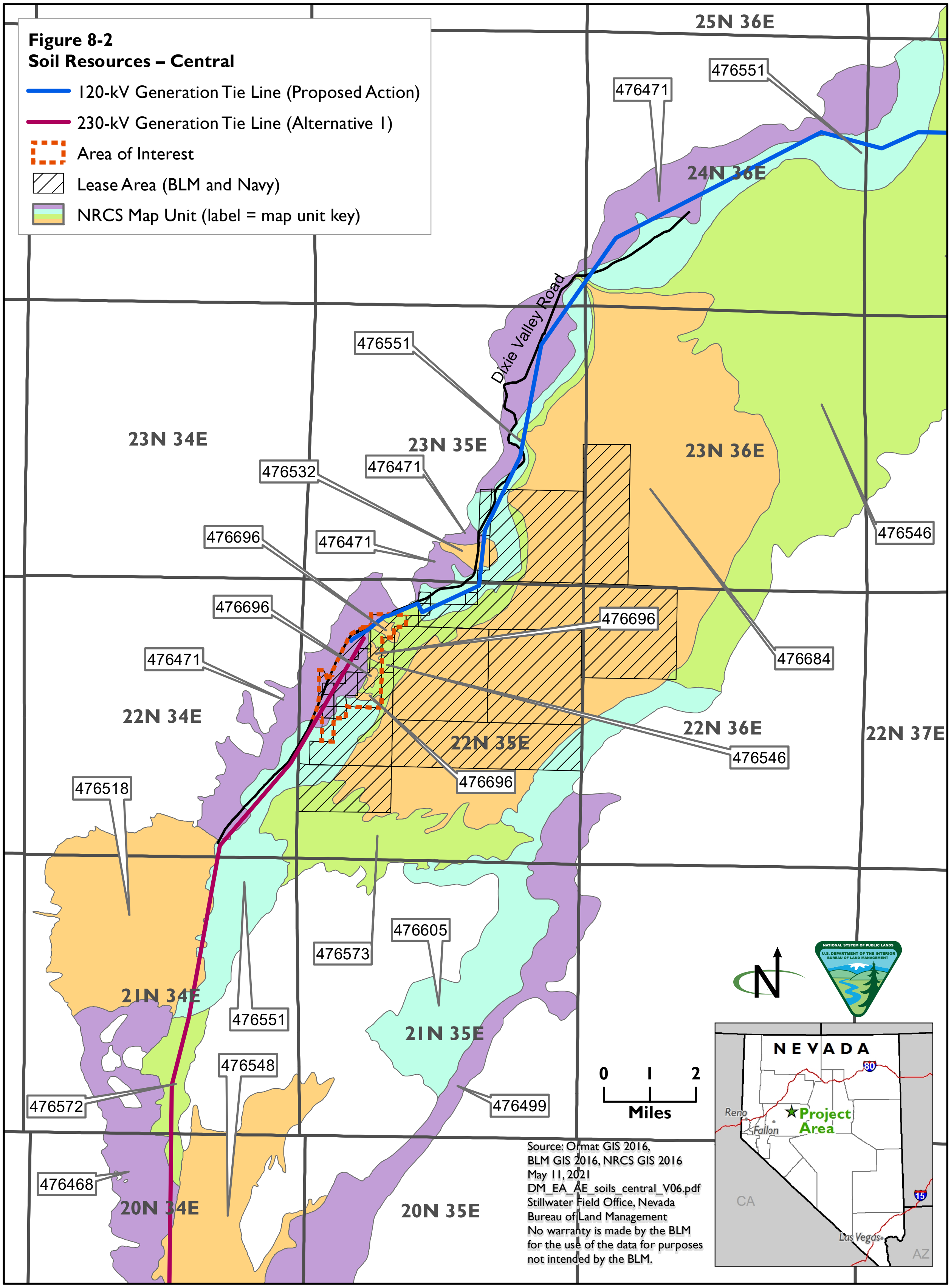
Figure 8-2
Soil Resources – Central
120-kV Generation Tie Line (Proposed Action)
230-kV Generation Tie Line (Alternative 1)
Area of Interest
Lease Area (BLM and Navy)
NRCS Map Unit (label = map unit key)
25N 36E
24N 36E
23N 34E
23N 35E
23N 36E
22N 34E
22N 35E
22N 36E
22N 37E
21N 34E
21N 35E
20N 34E
20N 35E
Dixie Valley Road
476551
476471
476532
476696
476546
476684
476518
476573
476605
476548
476572
476499
476468
0 1 2
Miles
Source: Ormat GIS 2016, BLM GIS 2016, NRCS GIS 2016
May 11, 2021
DM_EA_AE_soils_central_V06.pdf
Stillwater Field Office, Nevada
Bureau of Land Management
No warranty is made by the BLM for the use of the data for purposes not intended by the BLM.
NEVADA
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CA
Las Vegas
AZ

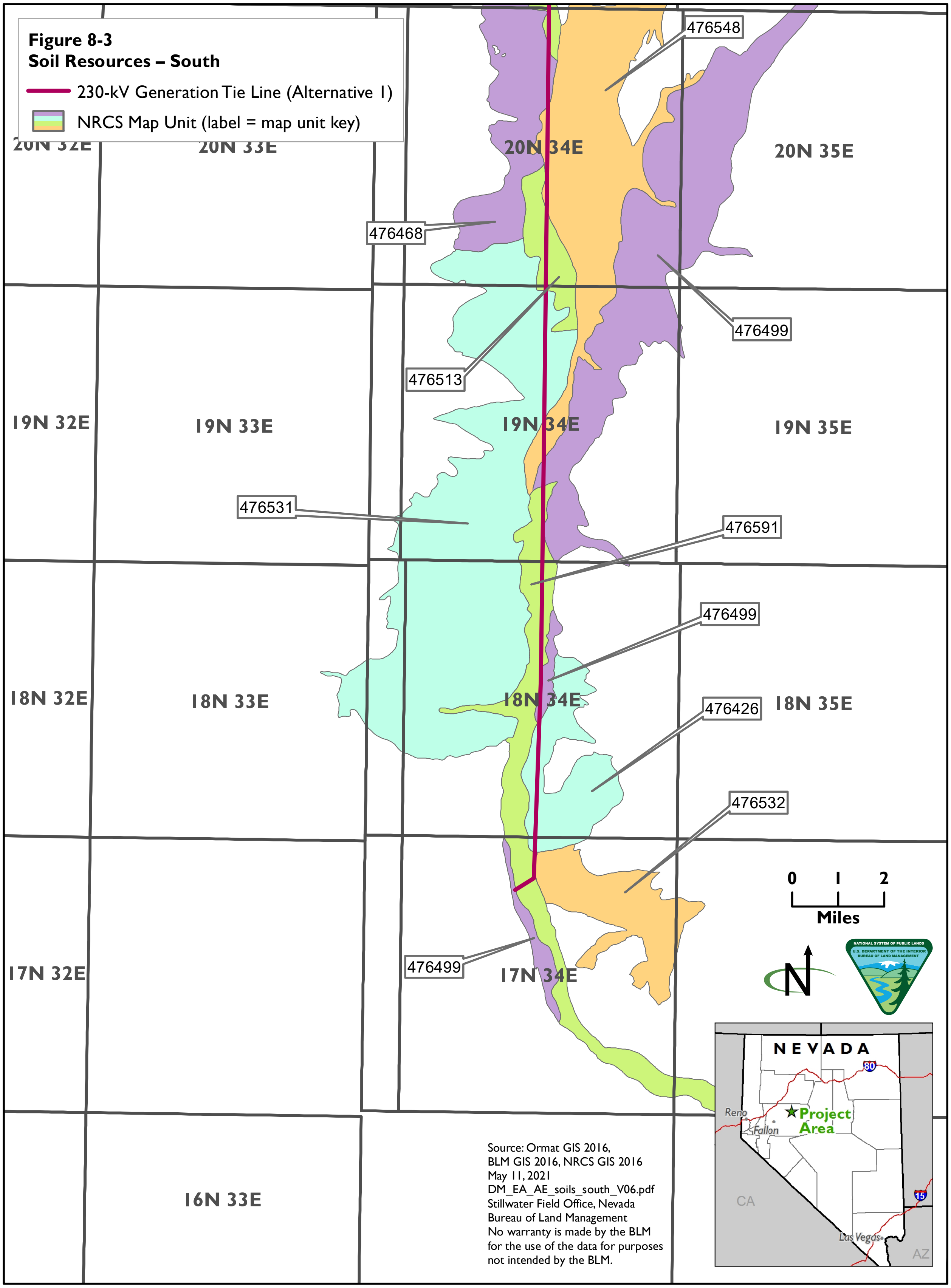

Figure 8-3
Soil Resources – South
230-kV Generation Tie Line (Alternative 1)
NRCS Map Unit (label = map unit key)
20N 32E
20N 33E
20N 34E
20N 35E
19N 32E
19N 33E
19N 34E
19N 35E
18N 32E
18N 33E
18N 34E
18N 35E
17N 32E
17N 34E
16N 33E
476548
476468
476499
476513
476531
476591
476426
476532
0 1 2
Miles
N
NEVADA
Reno
Fallon
Project Area
CA
AZ
Las Vegas
Source: Ormat GIS 2016,
BLM GIS 2016, NRCS GIS 2016
May 11, 2021
DM_EA_AE_soils_south_V06.pdf
Stillwater Field Office, Nevada
Bureau of Land Management
No warranty is made by the BLM
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not intended by the BLM.

The Pineval series consists of very deep, well drained soils that formed in alluvium derived from volcanic or mixed rocks. Pineval soils are on fan remnants and fan aprons. Slopes are 2 to 30 percent (NRCS 2016).

Mazuma very fine sandy loam, 0 to 4 percent slopes
The Mazuma series consists of very deep, well drained soils that formed in alluvium and lacustrine deposits derived from mixed rocks. Mazuma soils are on basin-floor remnants, lagoons, beach plains, alluvial flats, fan skirts, and stream terraces. Slopes are 0 to 30 percent (NRCS 2016).

The proposed wells and candidate power plant locations overlie the Bluewing-Pineval association, described above.

Pelic-Turupah complex, 0 to 1 percent slopes
The Pelic-Turupah complex, 0 to 1 percent slopes, consists of very poorly drained soils that formed from alluvium derived from mixed parent materials. Pelic-Turupah soils are on floodplains. Slopes are 0 to 2 percent for Pelic soils and 0 to 1 percent for Turupah soils (NRCS 2016). This soil map unit underlies most wetlands in Dixie Meadows.

This soil map unit is considered hydric. Hydric soils form under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (*Federal Register* 1994). Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of wetland vegetation.

Soil Erosion
The soils within the project area have been classified by NRCS for soil erosion susceptibility by wind or water. The wind erodibility group consists of soils that have similar properties affecting their susceptibility to wind erosion, and are classified on a scale between 1 and 8. A rating of 1 is given to soils that are highly susceptible to wind erosion, and a rating of 8 is given to soils that are the least susceptible to wind erosion (NRCS 2016). The Bluewing-Pineval association and Mazuma very fine sandy loam, 0 to 4 percent slopes soil unit both have ratings of 3, while the Slaw-Trocken-Chuckles association has a rating of 5. The Pelic-Turupah complex, 0 to 1 percent slopes, has a rating of 8.

The susceptibility of a soil to sheet and rill erosion by water was also classified and rated by NRCS. There are two rating estimates, the soil K factor (whole soil) and the erosion hazard. Soil K factor estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity, and indicates the erodibility of the whole soil (including the presence of rock fragments). The ratings for erosion hazard indicate the hazard of soil loss caused by sheet or rill erosion in areas where 50 to 75 percent of the soil surface has been exposed by logging, grazing, mining, or other kinds of disturbance. The ratings for erosion hazard are based on slope and soil erosion K factor. The hazard for both ratings are described as slight, moderate, severe, or very severe. A rating of slight indicates erosion is unlikely under ordinary climatic conditions (NRCS 2016). The hazard of soil loss to sheet and rill erosion by water is slight for the Bluewing-Pineval and Slaw-Trocken-Chuckles associations and the Mazuma very fine sandy loam, 0 to 4 percent slopes and Pelic-Turupah complex, 0 to 1 percent slopes units.

Fugitive Dust Potential

The soils within the project area have been rated by NRCS for their ability to resist the formation of fugitive dust emissions. This interpretation rates the vulnerability of a soil for eroded soil particles to go into suspension during a windstorm. The NRCS has rated soils for fugitive dust resistance to indicate the extent to which the soil features affect the formation of dust. Low resistance indicates the soil has features very favorable for the formation of dust; moderate resistance indicates the soil has features favorable for dust formation; and high resistance indicates the soil has features unfavorable for dust formation (NRCS 2016). The Slaw-Trocken-Chuckles association and the Mazuma very fine sandy loam, 0 to 4 percent slopes unit have low resistance to fugitive dust formation, while the Bluewing-Pineval association and Pelic-Turupah complex, 0 to 1 percent slopes, have moderate resistance to fugitive dust formation.

Soil Compaction

The soils within the project area have been classified by NRCS for soil compaction. Soil compaction is an important factor related to soil erosion as it tends to reduce water infiltration and increase runoff, which generally increases soil erosion rates. Each soil is rated for its resistance to compaction, which is predominantly influenced by moisture content; depth to saturation; percent of sand, silt, and clay; soil structure; organic matter content; and content of coarse fragments. A rating of high resistance indicates the soil is very favorable to resisting compaction; moderate resistance indicates the soil is favorable to resisting compaction; and low resistance indicates the soil has one or more factors that favor the formation of a compacted layer (NRCS 2016). The Slaw-Trocken-Chuckles association and the Pelic-Turupah complex, 0 to 1 percent slopes unit, have a low resistance to soil compaction; the Mazuma very fine sandy loam, 0 to 4 percent slopes unit has a moderate resistance to soil compaction; and the Bluewing-Pineval association has high resistance to soil compaction.

Soil Restoration Potential

Soils within the project area have been rated for their restoration potential and their inherent ability to recover from degradation, which is often referred to as soil resilience. The ability for a soil to recover from degradation means the ability to restore functional and structural integrity after a disturbance. Some soil functions important for restoration include sustaining biological activity, diversity, and productivity; capturing, storage, and release of water; storing and cycling nutrients and other elements; and providing support for plant and animal life. Restoration goals may include reestablishment of a preferred natural plant assemblage of the site. Soil resilience is dependent upon adequate stores of organic matter, good soil structure, low salt and sodium levels, adequate nutrient levels, microbial biomass and diversity, adequate precipitation for recovery, and other soil properties (NRCS 2016).

Rating class terms for soil restoration potential indicate the extent to which the soils are made suitable by the soil features that affect the soil's ability to recover. High potential indicates the soil has features very favorable for recovery, and good performance should be expected; moderate potential indicates the soil has features generally favorable for recovery, and fair performance can be expected; low potential indicates the soil has one or more features unfavorable for recovery, and poor performance can be expected. The Slaw-Trocken-Chuckles association, Bluewing-Pineval association, the Mazuma very fine sandy loam, 0 to 4 percent slopes unit, and Pelic-Turupah complex, 0 to 1 percent slopes unit all have low potential for soil restoration.

3.4.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)

Under the Proposed Action, up to 1,934 acres of soils would be disturbed. Of this total, approximately 1,823 acres of disturbance would be reclaimed and 111 acres of disturbance would not be reclaimed.

The Proposed Action could result in several effects on soils by (1) increasing erosion rates from grading and clearing of the site and/or (2) reducing soil productivity and potential restoration success by compacting the soil to a level that prevents successful rehabilitation and eventual reestablishment of vegetative cover to preconstruction composition and density.

Soil ratings of the three most prevalent soil map units in the project area and the Pelic-Turupah complex, 0 to 1 percent slopes unit suggest the susceptibility to sheet and rill erosion by water is slight. However, the susceptibility of these soils to wind erosion ranges from low to moderately high, and resistance to dust formation is low to moderate. The soils range from low to high in ability to resist compaction; however, these soils all rate low for their potential for soil recovery due to low amounts of available precipitation received annually.

The Proposed Action would disturb soil through clearing and grading during construction; protective vegetation, surface rock fragments, and soil structure would be removed and/or disturbed. Removal of vegetation and soil surface during construction would expose soil and increase the potential for wind- and water-driven erosion and soil compaction. The project site has generally flat topography, but grading would be performed on an as-needed basis to achieve the necessary slope and elevation for new facilities. This region also has the potential for high winds and infrequent strong rains, which could lead to increased erosion rates and soil loss. The use of vehicles and equipment on these disturbed areas could further increase the potential for wind- and water-driven erosion, as well as contributing to soil compaction, thus reducing restoration potential.

Hydric soils have been delineated by NRCS and occur within the Pelic-Turupah complex, 0 to 1 percent slopes. Direct impacts on hydric soils are not anticipated to occur. This is because the northern gen-tie alignment would follow the existing county road, outside of this soil type; also, **Appendix J**, **Section J.2.2** specifies that transmission towers, string sites, and other temporary work areas would be sited outside of identified hydric soils.

Indirect impacts on hydric soils could occur from utilization and injection of geothermal fluids during operations or from installation of the proposed northern gen-tie alignment. If water quantity were affected by project operations (utilization and injection), it could potentially cause reduction or loss of soil saturation. Additionally, if the proposed northern gen-tie alignment were to alter natural surface flow patterns, this could affect the hydrologic functions of these soils. If water quality were affected by project operations, this could affect nutrients stored in the hydric soils and in turn potentially lead to a loss of wetland and riparian vegetation.

Implementing mitigation measures outlined in **Appendix J** (see **Section J.2.2**), which primarily include avoiding surface disturbance in areas with hydric soils, would avoid impacts on hydric soils in the Pelic-Turupah complex, 0 to 1 percent slopes unit. Per the ARMMP (Section 3.9 in **Appendix H**), ORNI 32 would monitor hydric soils at tier-1 hydrological monitoring sites. Monitoring results would further inform the need for adaptive management and mitigation to avoid, minimize, or mitigate impacts on hydric soils.

To reduce the potential for water-driven erosion in the project area and any downgradient parcels, ORNI 32 would adhere to BMPs for access road construction, minimize cut and fill activities, and incorporate design features at the power plant sites to reduce erosion from stormwater runoff (see **Section J.1.1** in **Appendix J**).

Road construction BMPs specifying minimal grading would maintain existing stormwater drainage patterns and allow stormwater flows to pass through the area, to the extent possible. Construction-related erosion would be further controlled by implementing a stormwater pollution prevention plan (SWPPP), as required by the NDEP Bureau of Water Pollution Control, for projects that disturb over 1 acre.

To reduce the potential for wind-driven soil erosion, the speed limit on all project area roads (including Dixie Valley Road) would be 25 miles per hour. Periodically watering construction roads would help prevent fugitive dust generation and would minimize soil loss from wind erosion (see **Section J.1.1** in **Appendix J**). Reducing speed limits would also lessen soil compaction impacts and would aid in soil restoration and recovery.

Covering all drill pads and new access roads in 4 to 6 inches of gravel to create an all-weather, all-season surface would reduce the potential for soil loss from wind- and water-driven erosion. This surface would promote soil stability and would minimize soil loss and dust generation.

Temporarily disturbed areas would be restored following construction, which would promote soil stabilization in the long term. To increase the potential of restoration success, topsoil would be salvaged, stockpiled, and seeded during site preparation; it would then be used for site reclamation. Seeding stockpiled topsoil would encourage organic matter accumulation, higher rates of vegetation growth, and restoration success.

These measures would reduce the potential for wind- and water-born erosion and soil compaction and would increase soil restoration potential. However, localized loss of topsoil from wind- and water-driven erosion would still be expected.

Alternative 1 (Southern Gen-tie Route)

Impacts under Alternative 1 would be similar to those described for the Proposed Action except that the southern gen-tie alignment would result in 6 more acres of permanent disturbance. It would not overlap any Pelic-Turupah complex, 0 to 1 percent slopes soil units, so impacts on these soils are not anticipated. Soil resources-specific mitigation measures (**Appendix J**, **Section J.2.2**) would be the same as described under the Proposed Action.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the Proposed Action, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. As such, there would be no change in existing soil resources conditions at the site, and future impacts on soil resources from exploration activities would be avoided due to the suspension of activities.

3.5 MIGRATORY BIRDS

3.5.1 Affected Environment

On January 11, 2001, President Clinton signed Executive Order 13186 placing emphasis on the conservation and management of migratory birds. Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) of 1918, and the executive order addresses the responsibilities of federal agencies to protect migratory birds by taking actions to implement the MBTA. BLM management for migratory bird species on BLM-administered lands is based on Instruction Memorandum No. 2008-050 (BLM 2007b). Based on this instruction memorandum, migratory bird species of conservation concern include species of conservation concern and game birds below desired condition. The USFWS updated the list of species of conservation concern in 2008 (USFWS 2008).

There is also a memorandum of understanding (MOU) between the BLM and USFWS to promote the conservation of migratory birds. The purpose of the MOU is to strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and avoid or minimize adverse impacts on migratory birds through enhanced collaboration between the two agencies, in coordination with state, tribal, and local governments. The USFWS also outlined a plan to conserve and protect migratory birds in its Migratory Bird Program Strategic Plan in March 2019. The strategy includes direct collaboration with the BLM in making land use and planning decisions (USFWS 2004).

Migratory Birds

A field survey of the geothermal lease areas and northern gen-tie route was conducted by two EMPSi biologists between May 28 and 30, 2011. The survey included the area encompassing potential power plant sites and included a buffer of 250 feet on either side of the proposed northern gen-tie. Additional biological surveys were previously conducted within the original 4.9-acre Dixie Meadows lease area in 2009 (CH2M HILL 2009 in BLM 2010; see Figure 1 in EMPSi 2016). Two EMPSi biologists conducted additional field surveys on June 14 and 15, 2016. The survey covered approximately 400 acres of previously unsurveyed portions of the project area, as well as portions of the current northern gen-tie alignment that are outside the 500-foot-wide buffer originally surveyed in 2011.

Based on the habitats observed, numerous migratory bird species have the potential to occur within the project area. Thirty-three bird species were observed within and near the project area during field surveys, including passerines such as western wood pewee (*Contopus sordidulus*), black-throated sparrow (*Amphispiza bilineata*), horned lark (*Eremophila alpestris*), and raptors such as red-tailed hawk (*Buteo jamaicensis*) and northern harrier (*Circus cyaneus*). Complete lists of species observed during field surveys are included as Appendix D of the Biological Survey Report (EMPSi 2016).

Two active common raven (*Corvus corax*) nests were observed in the northern Dixie Valley during 2016 surveys. One nest was built in a small utility structure within the gen-tie survey buffer. A second nest was in a salt cedar (*Tamarix* sp.) shrub outside of the survey buffer, along Dixie Valley Road. Both nests contained several young that were approaching fledging age (EMPSi 2016).

Surveys for migratory birds were conducted within the geothermal lease areas and southern gen-tie route and within a 1-mile buffer of this route, between June and August 2013 (WRC 2013). Most of the species recorded during the 2013 surveys are common in the habitat types, such as the horned lark and black-throated sparrow. A list of all bird species observed during the 2013 surveys is included as Appendix D of the biological survey report (WRC 2013).

EMPSi coordinated with the Great Basin Bird Observatory (GBBO) to gain additional data on migratory birds observed near the Proposed Action.[19] GBBO provided point count data for five migratory bird transects within 6.2 miles (10 kilometers) of the Proposed Action (GBBO 2016). All point count surveys were conducted in June 2013. Migratory birds commonly observed by GBBO are black-throated sparrow and horned lark; for both species, breeding behavior was displayed at multiple point count locations. Breeding mourning dove (*Zenaida macroura*) was also observed. Nineteen species were observed by GBBO on the five transects.

The GBBO observed several USFWS birds of conservation concern. The sage sparrow (*Amphispiza belli*) and sage thrasher (*Oreoscoptes montanus*) have the potential to exist in the vicinity of the project area due to the presence of suitable habitat, as summarized below. GBBO observed loggerhead shrike (*Lanius ludovicianus*) and Brewer's sparrow (*Spizella breweri*) on one transect each; breeding behavior was not displayed for either species. Sage thrasher, loggerhead shrike, and Brewer's sparrow are sensitive species and are further discussed in **Section 3.8**, Sensitive Species.

Additional species reported by GBBO are red-tailed hawk, barn swallow (*Hirundo rustica*), blue-gray gnatcatcher (*Polioptila caerulea*), common nighthawk (*Chordeiles minor*), house finch (*Haemorhous mexicanus*), killdeer (*Charadrius vociferus*), northern mockingbird (*Mimus polyglottos*), rock wren (*Salpinctes obsoletus*), western kingbird (*Tyrannus verticalis*), and western meadowlark (*Sturnella neglecta*; GBBO 2016).

Finally, the 430,500-acre Lahontan Valley Wetlands important bird area (IBA) is located approximately 12 to 13 miles west of the project area. The IBA forms the most important waterfowl breeding and migratory site in Nevada and is critical to many species using the Pacific Flyway (Audubon Society 2016). Species using this important bird area may also use habitats in Dixie Valley or Jersey Valley.

Habitats found within the project area that support life requisites of migratory birds are described in detail in **Section 3.7**, Wildlife and Key Habitat.

Birds of Conservation Concern

Birds of conservation concern for bird conservation in Region 9 (Great Basin Region) that were observed in the project area, or that could potentially exist within the project area, are presented in **Table 13**. Birds of conservation

[19] GBBO has not been formally consulted through a contract agreement. GBBO played no role in the project other than providing data.

concern that are also sensitive species, such as the loggerhead shrike and sage thrasher, are discussed in **Section 3.8**, Sensitive Species.

Table 13
Birds of Conservation Concern

Species	Habitat	Potential for Occurrence
Sage sparrow (*Amphispiza belli*)	Treeless sagebrush or salt desert shrubland, with little or no cheatgrass invasion.	Potential to occur.
Long-billed curlew (*Numenius americanus*)	Grasslands and irrigated agricultural fields.	Potential to occur. Detected within 1 mile of project area.
Green-tailed towhee (*Pipilo chlorurus*)	Thickets, chaparral, shrublands, riparian scrub, and especially sagebrush.	Potential to occur.
Eared grebe (*Podiceps nigricollis*)	Marshes, ponds, and lakes; in migration and winter also salt lakes, bays, estuaries, and seacoasts. Nests in areas with seasonal to permanent water.	Potential to occur.
American avocet (*Recurvirostra americana*)	Open flats or areas with scattered tufts of grass on islands or along lakes (especially alkaline) and marshes.	The NAS Fallon has observed species in Dixie Valley Settlement Area.
Calliope hummingbird (*Stellula calliope*)	Mountains; along meadows, canyons, and streams, in migration and winter also in chaparral, lowland brushy areas, deserts.	Wintering habitat present; potential to winter in project area.

Sources: EMPSi 2016; USFWS 2008; 2016; WRC 2013; GBBO 2010; NatureServe 2015; Wildlife Action Plan Team 2012

Game Birds Below Desired Condition

USFWS game birds below desired condition that have been observed within or could potentially occur within the project area are presented in **Table 14**, below. This table represents species whose population is below long-term averages or management goals, or for which there is evidence of declining population trends (USFWS 2013). One species has been observed within the project area. Six additional species have been observed adjacent to the project within the Dixie Valley, and have potential to occur within the project (EMPSi 2016; WRC 2013).

Table 14
Game Birds Below Desired Condition

Species	Habitat	Potential for Occurrence
Canvasback (*Aythya valisineria*)	Marshes, ponds, lakes, rivers, and bays.	Potential to occur. Observed within Dixie Meadows during 2009 surveys.
Ring-necked duck (*Aythya collaris*)	Marshes, lakes, rivers, swamps, especially in wooded areas.	Potential to occur. Observed within Dixie Meadows during 2009 surveys.
Wood duck (*Aix sponsa*)	Quiet inland waters near woodland, such as wooded swamps, ponds, marshes, and along streams.	Potential to occur. Observed within Dixie Meadows during 2009 surveys.

Species	Habitat	Potential for Occurrence
Northern pintail (*Anas acuta*)	Lakes, rivers, marshes, and ponds in grasslands, barrens, dry tundra, or cultivated fields.	Potential to occur. Observed within Dixie Meadows during 2009 surveys and 2013 surveys.
Mallard (*Anas platyrhynchos*)	Primarily shallow waters.	Potential to occur. Observed within Dixie Meadows during 2009 surveys and 2013 surveys.
Canada goose (*Branta canadensis*)	Various habitats near water.	Observed on NAS Fallon lands in the Dixie Valley.
Mourning dove (*Zenaida macroura*)	Found in a variety of habitats except playas.	Observed within project area and within 1 mile of project area within Dixie Meadows during baseline surveys.

Sources: EMPSi 2016; WRC 2013; GBBO 2010; NatureServe 2015; USFWS 2004

3.5.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)

Implementation of the Proposed Action would result in direct loss of approximately 1,934 acres of habitat for migratory birds due to construction of the project components shown in **Table 4**. Of this total, approximately 1,823 acres of habitat would be reclaimed following construction, and 111 acres would not be reclaimed. Migratory birds could be displaced from areas of permanent habitat loss; however, the 111 acres of lost habitat would be small relative to the hundreds of thousands of acres of habitat available in Dixie Valley (see **Section 3.6**, Vegetation). Population viability for any one species would not be expected to be in jeopardy because of the habitat loss resulting from implementation of the Proposed Action.

The proposed wells would disturb up to approximately 27 acres of Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat vegetation that would not be reclaimed following construction (Ormat GIS 2016; SWReGAP GIS 2005). The proposed power plant(s) would disturb up to 32 acres of Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat vegetation that would not be reclaimed following construction (Ormat GIS 2016; SWReGAP GIS 2005). However, final plant(s) locations and, thus, the exact amount of disturbance in each vegetation type are not known at this time. Well and power plant(s) access roads and pipelines would also disturb these vegetation types. However, the final well and road locations and, thus, the exact amount of disturbance in each vegetation type are not known at this time.

The proposed gen-tie would cross seven vegetation types, as follows: 26.3 miles (55 percent) would cross Inter-Mountain Basins Mixed Salt Desert Scrub; 12.6 miles (26 percent) would cross Inter-Mountain Basins Greasewood Flat; 3.5 miles (7 percent) would cross Inter-Mountain Basins Big Sagebrush Shrubland; 3.2 miles (7 percent) would cross Invasive Annual Grassland; 1.3 miles (3 percent) would cross Invasive Annual and Biennial Forbland; 0.7 mile (1 percent) would cross Inter-Mountains Basins Playa (Ormat GIS 2016; SWReGAP GIS 2005).

EPMs under the Proposed Action include reclaiming disturbed areas to promote the reestablishment of native plant and wildlife habitat. A reclamation plan describing interim and final reclamation would be developed and implemented.

ORNI 32 has developed a BBCS (see **Appendix C**) for the project. Its purposes are to reduce the potential of injury or mortality to migratory birds from project construction and operation, to ensure adequate monitoring is in place to determine if mortalities are occurring, and to provide a mechanism to implement adaptive management as needed to reduce injury or mortality.

Construction activities under the Proposed Action could result in direct mortality to migratory birds. Activities, including site preparation, vegetation clearing, and grading, could injure or kill birds or destroy nests, eggs, or young, particularly those species that nest in shrubs or on the ground. To avoid direct mortality, preconstruction avian surveys would be conducted if construction activities must occur during the nesting season, as described in Section 5.1 of the BBCS. If active nests are present within the areas to be disturbed, ORNI 32 would coordinate with the BLM to develop appropriate protection measures for these sites. These measures may include avoidance, construction constraints, and the establishment of buffers.

Mortality may also occur from bird strike during drilling operations when drill rigs up to 50 feet tall may be used. Bird strike may be particularly pronounced for night-migrating species, which may become disoriented by nighttime lights on tall structures (Rich and Longcore 2006). To reduce this potential impact, lights on the drill rig derricks should pulse at the minimum intensity and minimum number of flashes per minute allowable by Federal Aviation Administration or other applicable regulations, as outlined in Section 5.1 of the BBCS.

Ponds, tanks, and impoundments (including but not limited to drill reserve pits) containing liquids can present hazards to migratory birds (BLM 2008b). Migratory bird access to any liquids contaminated by substances that may be harmful due to toxicity, fouling of the feathers (detergents and oils), or excessive temperatures would be prevented by wildlife-proof fencing, netting, or other covering at all times when not in active use. This measure would conform to Appendix D, Best Management Practices and Mitigation Measures, of the BLM's 2008 geothermal leasing PEIS (see **Appendix F**).

Indirect, temporary effects from noise, human presence, and heavy equipment present during construction activities may lead to displacement from suitable habitat. This may lead to reduced breeding and/or nesting success for individuals within or near the project footprint. This in turn may affect foraging opportunities for species that prey on adult birds, nestlings, or eggs. Raptor species that prey on small mammals, rodents, and lizards may avoid foraging within or adjacent to the project footprint during construction activities and could therefore be temporarily affected.

The noise from drilling wells and the construction of the geothermal power plant(s) would have a different effect on nearby birds than the noise from operation of the geothermal power plant(s). This is because the noise generated during drilling and construction are louder than the noise generated during plant operation. This noise may temporarily displace birds during drilling or construction activities. On the other hand, the consistent and lower decibel background noise emitted from a power plant inhibits birds' ability to hear sounds and communicate to each other. This explains why pairing success and nest density is significantly reduced in the presence of consistent anthropogenic noise (Barber et al. 2009). Therefore, temporary and/or permanent habitat loss may be greater than the actual project footprint.

Operation noise would be minimized by designing the plant to take advantage of noise-reducing design, including from cooling fans. Vinyl fencing slats surrounding the plants would also reduce operational noise in adjacent bird habitat. BLM regulations mandate that noise at one-half mile—or at the lease boundary if closer—from a major geothermal operation shall not exceed 65 A-weighted decibels (43 CFR 3200.4(b)).

Operation of the gen-tie could result in direct mortality from bird strikes and electrocution. This is particularly true for larger bird species and raptors. Due to the potential for electrocution, collision, and nesting or perching by migratory birds on overhead power lines, the APLIC guidelines (2006 and 2012) would be implemented to reduce this risk through facility design.

Due to implementation of the BBCS, the temporary nature of drilling- and construction-related noise, the minimal extent of operational noise effects from the power plant(s), and the minimal amount of habitat disturbance that would not be reclaimed (111 acres) relative to the hundreds of thousands of acres of available habitat around the project area, population viability for any one migratory bird species is not expected to be in jeopardy as a result of implementing the Proposed Action. Migratory bird nest surveys required prior to ground disturbance during the nesting season would prevent most direct impacts on migratory bird species. A qualified biologist acceptable to the BLM would conduct migratory bird nest surveys no more than 2 weeks prior to surface-disturbing activities. This survey would be conducted to identify either breeding adult birds or nest sites within the specific areas to be disturbed. If active nests are present within the areas to be disturbed, ORNI 32 would coordinate with the BLM to develop appropriate protection measures for these sites, which may include avoidance, construction constraints, and the establishment of buffers.

The impacts resulting from construction-related mortality (vehicle strike), construction noise, human presence, and presence of heavy equipment would be expected to be temporary and short term for the duration of the proposed construction and drilling activities. Impacts resulting from bird strike or electrocution due to the gen-tie would be minimized by implementing APLIC (2006 and 2012) guidelines. Therefore, impacts are not expected to jeopardize the viability of migratory bird populations. The Proposed Action would comply with the MBTA and Bald and Golden Eagle Protection Act (BGEPA) (see **Section 3.8**, Sensitive Species).

Alternative 1 (Southern Gen-tie Route)

The nature and type of impacts on migratory birds under Alternative 1 would be similar to those described under the Proposed Action. However, Alternative 1 would result in approximately 6 additional acres of permanent habitat loss for migratory birds. This is due to construction of the switching station.

Implementation of Alternative 1 would result in approximately 1,322 acres of habitat disturbance for migratory birds; of this total, 1,205 acres would be reclaimed following construction, and 117 acres would not be reclaimed, as summarized in **Table 6**.

The amount of vegetation type disturbance from wells, power plant(s), and access roads and pipelines would be the same as described under the Proposed Action.

The gen-tie under Alternative 1 would cross four vegetation types, as follows: 22.7 miles (73 percent) would cross Inter-Mountain Basins Mixed Salt Desert Scrub; 7 miles (22 percent) would cross Inter-Mountain Basins Greasewood Flat; 1.6 miles (5 percent) would cross Invasive Annual and Biennial Forbland; and less than 0.1 miles (less than 1 percent) would cross Inter-Mountain Basins Active and Stabilized Dune (Ormat GIS 2016; SWReGAP GIS 2005).

EPMs and their associated impacts under Alternative 1 are the same as those described under the Proposed Action. Alternative 1 would be in compliance with the MBTA and the BGEPA.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the Proposed Action, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. As such, there would be no change in existing migratory bird migration, foraging, or nesting conditions at the site.

3.6 Vegetation

3.6.1 Affected Environment

Table 15, below, presents the Southwest Regional Gap Analysis Project (SWReGAP) landcover types, a summary of landcover type descriptions, and associated acreages within the geothermal lease areas and the gen-tie routes and buffers around the gen-tie routes. The Biological Survey Report (EMPSi 2016) and the Baseline Wildlife Survey (WRC 2013) include detailed descriptions of each SWReGAP landcover type within the project area. The ARMMP includes detailed descriptions of spring-dependent vegetation types; these are discussed in more detail in **Section 3.9**, Wetlands and Riparian Areas.

Coverage areas for both surveys included the proposed geothermal lease sites; but the precise survey boundaries varied slightly between the two surveys. For these reasons, acres of landcover types reported are approximate and cannot simply be added together to give a total of each landcover type in the project area. Nevertheless, reported acres represent the relative abundance of each landcover type in the project area.

Plant species commonly observed in the project area include Indian ricegrass (*Achnatherum hymenoides*), budsage (*Artemisia spinescens*), four-wing saltbush (*A. canescens*), shadscale (*A. confertifolia*), cheatgrass (*Bromus tectorum*), yellow rabbitbrush (*Chrysothamnus viscidiflorus*), halogeton (*Halogeton glomeratus*), winterfat (*Krascheninnikovia lanata*), Russian thistle or tumbleweed (*Salsola tragus*), greasewood (*Sarcobatus* spp.), and seepweed (*Suaeda nigra*; ESRS 2013).

Table 15
SWReGAP Landcover Types

SWReGAP Landcover Type	Landcover Description	Approximate Acres		
		Northern Gen-Tie[1]	Southern Gen-Tie[2]	Geothermal Lease Areas
Inter-Mountain Basins Mixed Salt Desert Scrub	Open-canopied shrublands of typically saline basins, alluvial slopes, and plains; substrates are often saline and calcareous, medium- to fine-textured, alkaline soils; vegetation characterized as typically open to moderately dense shrubland composed of one or more saltbush (*Atriplex*) species; herbaceous layer varies from sparse to moderately dense.	638	2,545	283

SWReGAP Landcover Type	Landcover Description	Approximate Acres		
		Northern Gen-Tie[1]	Southern Gen-Tie[2]	Geothermal Lease Areas
Inter-Mountain Basins Greasewood Flat	Typically occurs near drainages on stream terraces and flats or may form rings around more sparsely vegetated playas; typically have saline soils, a shallow water table and flood intermittently, but remain dry for most growing seasons; usually occurs as a mosaic of multiple communities, with open to moderately dense shrublands dominated or co-dominated by greasewood (*Sarcobatus* spp.); often surrounded by mixed salt desert scrub.	305	477	247
Invasive Shrubland, Forbland, or Grassland	Areas dominated by introduced shrubs and/or annual, biennial, and/or perennial forbs and grasses.	110	198	0
Inter-Mountain Basins Big Sagebrush Shrubland	Occurs in broad basins between mountain ranges, plains, and foothills. Soils are typically deep, well-drained, and non-saline. These shrublands are dominated by big sagebrush (*Artemisia tridentata* ssp. *tridentata* or *A. t.* ssp. *wyomingensis*). Perennial herbaceous components usually contribute less than 25% vegetative cover.	83	0	0
North American Arid West Emergent Marsh	The ARMMP includes detailed descriptions of spring-dependent vegetation types; these are discussed in more detail in **Section 3.9**, Wetlands and Riparian Areas.	12	0	5
Inter-Mountain Basins Playa	Composed of barren and sparsely vegetated playas (generally less than 10 percent plant cover); salt crusts are common, with small saltgrass (*Distichlis* sp.) beds in depressions and sparse shrubs around the margins; intermittently flooded.	18	8	0
Inter-Mountain Basins Active and Stabilized Dune	Often composed of a mosaic of migrating, bare dunes; anchored dunes with sparse to moderately dense vegetation (less than 10 to 30 percent canopy cover); and stabilized dunes.	0	3	0

Source: EMPSi 2016; WRC 2013; USGS 2005; SWReGAP GIS 2005
[1] Acreage calculated within a 100-foot buffer of the proposed northern gen-tie route
[2] Acreage calculated within a 200- to 500-foot buffer from the southern gen-tie route

3.6.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)

Implementation of the Proposed Action would result in disturbance of approximately 1,934 acres of vegetation due to construction of the project components shown in **Table 4**. Of this total, 1,823 acres would be reclaimed following construction, and approximately 111 acres would not.

Proposed wells would disturb up to 27 acres of Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat vegetation that would not be reclaimed following construction (Ormat GIS 2016; SWReGAP GIS 2005). The proposed power plant(s) would disturb up to 32 acres of Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat vegetation that would not be reclaimed following construction (Ormat GIS 2016; SWReGAP GIS 2005). Well and power plant(s) access roads and pipelines would also disturb these vegetation types. However, the final plant(s), well, and road locations and, thus, the exact amount of disturbance in each vegetation type are not known at this time.

The proposed gen-tie would cross seven vegetation types, as follows: 26.3 miles (55 percent) would cross Inter-Mountain Basins Mixed Salt Desert Scrub; 12.6 miles (26 percent) would cross Inter-Mountain Basins Greasewood Flat; 3.5 miles (7 percent) would cross Inter-Mountain Basins Big Sagebrush Shrubland; 3.2 miles (7 percent) would cross Invasive Annual Grassland; 1.3 miles (3 percent) would cross Invasive Annual and Biennial Forbland; and 0.7 miles (1 percent) would cross Inter-Mountains Basins Playa (Ormat GIS 2016; SWReGAP GIS 2005).

The gen-tie in the northern portion of Dixie Meadows would follow the existing county road and would be built outside of North American Arid West Emergent Marsh vegetation. Further, implementing EPMs in **Appendix J**, **Section J.2.2** would avoid surface grading, vegetation clearing, and the siting of other temporary work areas in these areas. Because the gen-tie would be constructed outside of this vegetation type, direct impacts are not anticipated.

Indirect impacts would be avoided, minimized, or mitigated by implementing minimization and mitigation measures proposed for water resources (see **Section 3.3.2**) and wetlands and riparian vegetation (see **Section 3.9.2**). EPMs under the Proposed Action include reclaiming temporarily disturbed areas to promote the reestablishment of native vegetation. A reclamation plan describing interim and final reclamation would be developed and implemented.

Indirect impacts on vegetation would include the potential for increased weed establishment and spread from soil disturbance during construction. The EPMs outlined in **Appendix J** would reduce the potential for weed establishment and spread; these protection measures include preparing an invasive plant management plan prior to construction, reporting noxious weeds to the BLM, and using a BLM-approved, weed-free seed mix in reclamation activities.

Indirect effects could also result from fugitive dust generated during construction that settles on vegetation, reducing productivity. EPMs include dust control measures during construction to minimize this effect.

Alternative 1 (Southern Gen-tie Route)

The nature and type of impacts on vegetation under Alternative 1 would be the same as those described under the Proposed Action, with the exception that impacts under Alternative 1 would occur on approximately 6 more acres of proposed vegetation disturbance. This is due to the construction of the switching station.

Implementation of Alternative 1 would result in disturbance of approximately 1,322 acres of vegetation; of this total, 1,205 acres would be reclaimed following construction, and 117 acres would not, as summarized in **Table 6**.

The amount of vegetation type disturbance from wells, power plant(s), and access roads and pipelines would be the same as described under the Proposed Action.

The gen-tie under Alternative 1 would cross four vegetation types, as follows: 22.7 miles (73 percent) would cross Inter-Mountain Basins Mixed Salt Desert Scrub; 7 miles (22 percent) would cross Inter-Mountain Basins Greasewood Flat; 1.6 miles (5 percent) would cross Invasive Annual and Biennial Forbland; and less than 0.1 miles (less than 1 percent) would cross Inter-Mountain Basins Active and Stabilized Dune (Ormat GIS 2016; SWReGAP GIS 2005).

The southern gen-tie does not traverse Dixie Meadows or North American Arid West Emergent Marsh vegetation. Direct and indirect impacts on this vegetation type from construction and maintenance of the southern gen-tie are not anticipated.

Implementing EPMs (**Appendix J**) under Alternative 1 would result in the same avoidance, minimization, or mitigation of impacts as those described under the Proposed Action.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the project, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. As such, there would be no change in existing vegetation conditions at the site.

3.7 WILDLIFE AND KEY HABITAT

3.7.1 Affected Environment

Table 16, below, presents the habitat types (based on SWReGAP landcover types presented in **Section 3.6**, Vegetation) within the project area and the typical associated wildlife species within the Great Basin. Species documented during surveys were typical for the habitat types observed. A total of 33 bird, 11 mammal, and 5 reptile species were directly observed or detected by sign (e.g., tracks, burrows, or scat) within the project area or within 1 mile of the project area during surveys (EMPSi 2016). A total of 28 bird, 9 mammal, 7 reptile, and 1 amphibian species were directly observed or detected by sign (e.g., tracks, burrows, or scat) in the project survey area and 1-mile buffer during the 2013 surveys, and 17 of the bird species were only recorded at Dixie Meadows (WRC 2013). A complete list of wildlife species observed during the field surveys is included in the biological survey reports (EMPSi 2016; WRC 2013) in **Appendix D**, Biological Survey Reports.

Table 16
Typical Wildlife Species Associated with Habitats in the Project Area

Habitat Type[1]	Associated Species
Inter-Mountain Basins Mixed Salt Desert Scrub	Pronghorn antelope (*Antilocapra americana*); coyote (*Canis latrans*); Great Basin pocket mouse (*Perognathus parvus*); common raven (*Corvus corax*); side-blotched lizard (*Uta stansburiana*)
Inter-Mountain Basins Greasewood Flat	Black-tailed jackrabbit (*Lepus californicus*); white-tailed antelope squirrel (*Ammospermophilus leucurus*); black-throated sparrow; horned lark; desert horned lizard (*Phrynosoma platyrhinos*)
Invasive Shrubland, Forbland, or Grassland	Common raven; red-tailed hawk; horned lark; pronghorn antelope; collared lizard (*Crotaphytus bicinctores*)
Inter-Mountain Basins Big Sagebrush Shrubland	Sage sparrow; Great Basin fence lizard (*Sceloporus occidentalis longipes*); western kingbird (*Tyrannus verticalis*)
Inter-Mountain Basins Active and Stabilized Dunes	Dune invertebrates including beetles, solitary bees, crickets, ants, kangaroo rats (*Dipodomys deserti*)
North American Arid West Emergent Marsh	Yellow-headed blackbird (*Xanthocephalus xanthocephalus*); marsh wren (*Cistothorus palustris*); spotted sandpiper (*Actitis macularius*); bullfrog (*Rana catesbeiana*)
Inter-Mountain Basins Playa	Pocket gopher (*Thomomys bottae*); killdeer (*Charadrius vociferus*); American avocet; black-necked stilt (*Himantopus mexicanus*)

Source: EMPSi 2016; NDOW 2012

[1] Based on SWReGAP landcover types

Based on the SWReGAP (2005), the NDOW's Wildlife Action Plan (2012) characterized Nevada's vegetative land cover into broad ecological system groups and linked those with 22 key habitat types. Along with survey data, key habitats can be used to infer likely occurrences of wildlife species assemblages. Key habitat types within the project area include:

- Cold Desert Scrub (corresponding to SWReGAP Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat)
- Sagebrush (corresponding to SWReGAP Inter-Mountain Basins Big Sagebrush Shrubland)
- Desert Playas and Ephemeral Pools (corresponding to SWReGAP Inter-Mountain Basins Playa)
- Marshes (corresponding to SWReGAP North American Arid West Emergent Marsh)
- Sand Dunes and Badlands (corresponding to SWReGAP Inter-Mountain Basins Active and Stabilized Dunes)

Cold Desert Scrub is an important habitat in Nevada for several sensitive species. Soils of this habitat tend to be loose and either sandy or gravelly and are often easy to dig. Blow sand tends to accumulate around the shrubby bases of the saltbushes, particularly shadscale (*Atriplex confertifolia*). This creates hummocks of soil that lend themselves to burrowing and denning. Cold Desert Scrub serves as an important support habitat for several avian sagebrush breeders, including sage sparrow.

In Nevada, species predominantly dependent on sagebrush habitat for most of their life history needs include Great Basin pocket mouse, sagebrush vole (*Lemmiscus curtatus*), sagebrush lizard (*Sceloporus graciosus*), and sage sparrow. Sagebrush range in good condition also supports a lush undergrowth of bunchgrasses and forbs. The presence of this highly productive understory is critical to the needs of other wildlife species, including the sagebrush vole. The various shrew (*Sorex* spp.) species that live in sagebrush are insectivores, but they depend on the productivity of the herbaceous component for the abundant production of their prey items, as well as for cover.

When playas contain water for extended periods of time, lush vegetation can grow in addition to producing many aquatic invertebrates that provide forage for shorebirds, waterfowl, and small water birds. Several permanent water sources drain onto the playa area near the possible power plant locations. The volume of water discharged from these sources does not provide for complete inundation of the playa. These water sources and aquatic habitats associated with them support riparian vegetation. They also provide migratory waterfowl habitat. These and other amphibians, like the Great Basin spadefoot toad (*Spea intermontana*), have been observed in the southern portion of the Dixie Valley (NAS Fallon 2011).

Seasonal inundation of the playa area, generally during spring when snowmelt runoff is greatest, would provide additional open water habitat for herons, egrets, bitterns, ducks, geese, and other birds associated with open water. Marshes are among Nevada's most diverse and prolific wildlife habitats. The occurrence of marshes on the landscape is critical to both breeding and migratory needs of many species of birds.

Sand dunes and badlands include ecological systems defined by substrate characteristics rather than by vegetative cover (e.g., weathered soil patches and aeolian deposits). Sand dunes and badlands often define unique habitats and support endemic plants and animals, as well as provide habitat for generalist species. Many sand dune systems in Nevada have a high diversity of dune invertebrates, including beetles, solitary bees, crickets, and ants, some of which are sand dune obligates (Nachlinger et al. 2001). Annual seed production is positively correlated with rainfall in sand dune habitats, and as a result, the diversity of seed-eating rodents and perennial shrubs in these habitats is directly tied to annual rainfall. Desert kangaroo rats primarily feed on seeds in sand dune habitats. Sand dune species may burrow in the sand to rest, forage, and build nests. Prey-seeking species are drawn to sand dune habitats to feed on small mammals, lizards, and other inhabitants.

Big Game

The BLM manages habitat for game species. The Stillwater Range in the vicinity of the project area is year-round mule deer (*Odocoileus hemionus*) and pronghorn antelope range, and potential elk (*Cervus canadensis nelsoni*) habitat (BLM 2015b). Multiple big and small game guzzlers are located to the east and south of the project.

EMPSi coordinated with NDOW before the 2016 field survey. NDOW indicated that there are occupied bighorn sheep and pronghorn antelope distributions in portions of the project area and within a 4-mile buffer of the project area. NDOW also reported occupied year-round, crucial summer, and crucial winter mule deer distribution within the 4-mile buffer area. No occupied elk habitat exists in the vicinity of the project area. No mule deer were observed in the project area; however, an old three-point shed was found within the 1-mile survey buffer from the southern gen-tie route (WRC 2013).

Pronghorn antelope was the only big game species that was observed within the project area during field surveys. Antelope was observed in both Dixie Valley and Jersey Valley during the 2011 and 2016 surveys (EMPSi 2016). A total of three antelopes were observed in Jersey Valley (the next valley north of Dixie Valley) in mixed salt desert scrub and invasive grassland habitats in 2011. In 2016, a small herd of antelope, including several juveniles, was observed foraging on irrigated alfalfa in Dixie Valley. A few additional antelopes were observed in mixed salt desert scrub. Antelope scat and tracks were also noted throughout the project area.

Other Wildlife

An active kit fox (*Vulpes macrotis*) burrow complex was recorded in the northern gen-tie buffer area in the northern Dixie Valley. No kit foxes were observed, but recent jackrabbit prey remains and scat were present at the burrow complex location.

3.7.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)
Implementation of the Proposed Action would result in disturbance of approximately 1,934 acres of wildlife habitat, consisting primarily of Cold Desert Scrub, due to construction of the project components shown in **Table 4**. Of this total, approximately 1,823 acres would be reclaimed following construction, and 111 acres would not. The 111 acres of lost habitat would be small relative to the abundant Cold Desert Scrub habitat available in Dixie Valley.

Proposed wells would disturb up to 27 acres of Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat habitat that would not be reclaimed following construction (Ormat GIS 2016; SWReGAP GIS 2005). The proposed power plant(s) would disturb up to 32 acres of Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat habitat that would not be reclaimed following construction (Ormat GIS 2016; SWReGAP GIS 2005). However, final plant(s) locations and, thus, the exact amount of disturbance in each habitat type are not known at this time. Well and power plant(s) access roads and pipelines would also disturb these habitats. However, the final well and road locations and, thus, the exact amount of disturbance in each habitat type are not known at this time.

The proposed gen-tie would cross seven key habitat types, as follows: 26.3 miles (55 percent) would cross Inter-Mountain Basins Mixed Salt Desert Scrub; 12.6 miles (26 percent) would cross Inter-Mountain Basins Greasewood Flat; 3.5 miles (7 percent) would cross Inter-Mountain Basins Big Sagebrush Shrubland; 3.2 miles (7 percent) would cross Invasive Annual Grassland; 1.3 miles (3 percent) would cross Invasive Annual and Biennial Forbland; and 0.7 miles (1 percent) would cross Inter-Mountains Basins Playa (Ormat GIS 2016; SWReGAP GIS 2005).

Implementing EPMs under the Proposed Action (**Appendix J**), such as reclaiming temporarily disturbed areas, would promote the reestablishment of native plant and wildlife habitat. A reclamation plan describing interim and final reclamation would be developed and implemented. An invasive plant management plan would be developed and implemented prior to construction, which would ensure that there is no net increase in the amount of weeds on-site during the life of the project.

Generally, construction under the Proposed Action would have similar nature and type of impacts on wildlife as described under **Section 3.5**, Migratory Birds. Additional impacts are described below.

Surface disturbance under the Proposed Action could result in potential mortality from vehicle collisions and destruction of underground burrows for reptiles and small mammals that forage and/or have burrow complexes within the work areas. This habitat loss and disturbance may lead to reduced breeding success for individuals that are displaced into surrounding areas as well as those affected by the fragmentation of the overall footprint of the project. This, in turn, may affect distribution of large mammals, such as big game, and raptors that forage on rodents and small mammals. EPMs described in **Appendix J**, **Section J.1.4**, including reclamation of temporarily disturbed areas, would minimize permanent habitat loss. Speed limits for construction and operational traffic would minimize potential mortality from vehicle strike. Limiting vehicle and equipment travel to established roads and roads that are part of the Proposed Action would reduce the potential for burrow damage.

Larger species, such as big game, may be impacted by construction noise or human presence caused by project development. These impacts are expected to be temporary and would affect individuals and local groups of animals using or migrating through the area during construction.

Indirect, temporary effects on wildlife from construction typically come from increased noise, human presence, and heavy equipment present during construction activities. These brief, loud noises are more likely to be perceived as predatory sounds, which may elicit an artificial "fight or flight" response. The presence of construction workers, equipment, and noise could cause animals to avoid the area during construction activities.

Indirect impacts on wildlife and habitat would include potential for increased weed establishment and spread from soil disturbance during construction. Weed spread may alter habitat conditions, resulting in less suitable habitat for wildlife species. EPMs outlined in **Appendix J**, **Section J.1** would reduce potential for weed establishment and spread, including preparing an invasive plant management plan prior to construction, reporting noxious weeds to the BLM, and using a BLM-approved, weed-free seed mix in reclamation activities. As a result, the Proposed Action would have no net increase in the amount of weeds on-site during the life of the project.

Indirect effects could also result from fugitive dust generated during construction that settles on vegetation, reducing productivity and degrading wildlife habitat. EPMs outlined in **Appendix J**, **Section J.1** include dust control measures during construction to minimize this effect.

The proposed gen-tie would follow the existing county road and would be built outside of North American Arid West Emergent Marsh vegetation in the northern portion of Dixie Meadows. The wetlands and riparian vegetation and open waters associated with seeps, springs, and seasonal ponds in this area provide critical habitat for wildlife species. The number and diversity of terrestrial and aquatic species that use this area are likely elevated, compared with other portions of the gen-tie alignment. Construction of the gen-tie may result in indirect changes in hydrology and functioning of the wetland or playa habitat that are critical for wildlife. Therefore, the impacts described above could be higher in the Dixie Meadows area, compared with other portions of the gen-tie alignment. Indirect impacts would be avoided, minimized, or mitigated by implementing minimization and mitigation measures proposed for water resources (see **Section 3.3.2**) and wetlands and riparian vegetation (see **Section 3.9.2**).

Compared with construction, operation would result in fewer impacts on wildlife. During operation there would be no additional habitat loss, a lower probability for mortality from collision with vehicles, less loud noises, and fewer humans at the proposed project site.

The quieter and more consistent background noise associated with power plant operation could affect animals' ability to perceive sounds. This would affect different species differently, depending on how they use sound and the frequency of these sounds. Rodents that use chirps to warn of predators may be susceptible to increased predation, because these chirps may be masked from the power plant noise (Barber et al. 2009). This, in turn, may affect the distribution of predators. In effect, noise may create a larger area of habitat disturbance than the project footprint alone.

Operation noise would be minimized by designing the plants to take advantage of a noise-reducing design, including from cooling fans, as described in **Section 2.1.3**. Vinyl fencing slats surrounding the plants would also reduce operational noise in adjacent habitat. BLM regulations mandate that noise at one-half mile—or at the lease boundary if closer—from a major geothermal operation shall not exceed 65 A-weighted decibels (43 CFR 3200.4(b)). To comply with this requirement, vinyl fencing slats would be constructed around noise-generating project components. Migrating individuals may avoid the power plant locations; however, given the amount of undisturbed habitat in the vicinity, migration routes and habitat connectivity are not expected to be significantly affected by project operations.

Ponds, tanks, and impoundments (including but not limited to drill reserve pits) containing liquids can present hazards to wildlife (BLM 2008b). Wildlife access to any liquids contaminated by substances that may be harmful due to toxicity, fouling of the fur (detergents and oils), or excessive temperatures would be excluded by wildlife proof-fencing, netting, or other covering at all times when not in active use. Clean water impoundments can also present a trapping hazard if they are steep-sided or lined with smooth material. To avoid impacts, any pits that present a wildlife trapping hazard would be fitted or constructed with an escape ramp. These measures would conform to Appendix D, Best Management Practices and Mitigation Measures, of the BLM's 2008 geothermal leasing PEIS (see **Appendix F** of this EA) and NDOW's Geothermal Sump Guidelines (NDOW, no date).

Implementing the Proposed Action is not expected to have significant impacts on wildlife species or populations. This would be due to the minimal extent of operational noise effects and the amount of habitat that would not be reclaimed (111 acres), relative to the hundreds of thousands of acres of available habitat around the project area. Impacts from dust, noise, human presence, and the presence of heavy equipment during construction would be temporary and short term for the duration of the construction and drilling activities. Operational impacts are expected to be minor.

Alternative 1 (Southern Gen-tie Route)

The nature and type of impacts on wildlife and key habitats under Alternative 1 would be similar to those described under the Proposed Action. However, Alternative 1 would result in approximately 6 more acres of habitat loss for wildlife as summarized in **Table 6**. Regardless of the gen-tie routing option chosen under Alternative 1, impacts on wildlife and key habitats species from either routing option would be the same.

Implementation of Alternative 1 would result in disturbance of approximately 1,322 acres of wildlife habitat. Of this total, 1,205 acres would be reclaimed following construction, and 117 acres would not.

The amount of key habitat disturbance from wells, power plant(s), and access roads and pipelines would be the same as described under the Proposed Action.

The gen-tie under Alternative 1 would cross four key habitat types, as follows: 22.7 miles (73 percent) would cross Inter-Mountain Basins Mixed Salt Desert Scrub; 7 miles (22 percent) would cross Inter-Mountain Basins Greasewood Flat; 1.6 miles (5 percent) would cross Invasive Annual and Biennial Forbland; and less than 0.1 miles (less than 1 percent) would cross Inter-Mountain Basins Active and Stabilized Dune (Ormat GIS 2016; SWReGAP GIS 2005).

The southern gen-tie route would not impact the Dixie Meadows or any other seeps, springs, wetland, or riparian vegetation. Because this alternative does not include potential indirect effects from gen-tie construction or operation in wetlands or riparian areas, direct and indirect impacts on wildlife habitat during critical breeding and migration periods would likely be reduced, compared with the Proposed Action.

EPMs described in **Appendix J**, **Section J.1** and their associated impacts under Alternative 1 are the same as those described under the Proposed Action.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the project, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. As such, there would be no change in existing wildlife habitat or vegetation conditions at the site.

3.8 Sensitive Species

Sensitive species are defined in BLM Manual 6840 (Special Status Species Management) as native species found on BLM-administered lands for which the BLM has the capability to significantly affect the conservation status of the species through management and either one of the following:

1. There is information that a species has recently undergone, is undergoing, or is predicted to undergo a downward trend such that the viability of the species or a distinct population segment of the species is at risk across all or a significant portion of the species range; or
2. The species depends on ecological refugia or specialized or unique habitats on BLM-administered lands, and there is evidence that such areas are threatened with alteration such that the continued viability of the species in that area would be at risk (BLM 2008d).

The objectives of the sensitive species policy are twofold, as follows:

1. To conserve or recover species listed under the Endangered Species Act of 1973 (ESA; 16 USC 1531 et seq.), as amended, and the ecosystems on which they depend so that ESA protections are no longer needed for these species
2. To initiate proactive conservation measures that reduce or eliminate threats to sensitive species to minimize the likelihood of and need for listing of these species under the ESA

Greater sage-grouse (*Centrocercus urophasianus*) was a former candidate for listing under the ESA. However, on September 21, 2015, the ROD and Approved Resource Management Plan Amendments for the Great Basin Sub-Region (BLM 2015a) were signed by the Director of the BLM and the Assistant Secretary of Land and Minerals Management. The USFWS made a determination that the greater sage-grouse does not warrant protection under the ESA. However, as the BLM considers the greater sage-grouse a sensitive species, it is protected under the BLM's Decision as a special status species. Greater sage-grouse is discussed further below.

The BGEPA (1940, as amended) prohibits the take or possession of bald and golden eagles with limited exceptions. Take, as defined in the BGEPA, includes "to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb" (16 USC 668c). Disturb means "to agitate or bother a bald or golden eagle to a degree that causes or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding or sheltering behavior" (50 CFR 22.3).

Important eagle-use area is defined in the BGEPA as an "eagle nest, foraging area, or communal roost site that eagles rely on for breeding, sheltering, or feeding, and the landscape features surrounding such nest, foraging area, or roost site are essential for the continued viability of the site for breeding, feeding, or sheltering eagles" (50 CFR 22.3). The BLM requires consideration of golden eagles and their habitat in the NEPA analysis for all renewable energy projects (BLM Instruction Memorandum No. 2010-156).

3.8.1 Affected Environment

A list of sensitive species associated with BLM-administered lands in Nevada was published in 2017 (BLM 2017). A springsnail survey was conducted in Dixie Meadows in 2018 (Stantec 2019). Field surveys of the geothermal lease areas and the northern gen-tie route for sensitive species were conducted in 2011 and 2016 (EMPSi 2016). Surveys of the geothermal lease areas and the southern gen-tie route were conducted in 2013 (WRC 2013; ESRS 2013). Sensitive plant and wildlife species observed during the surveys, previously documented within or near the project area, or with potential to occur in the project area are included in **Table 17**.

Table 17
Sensitive Species
Observed or Potentially Occurring in the Project Area

Species	Habitat	Potential for Occurrence
Plants		
Sodaville milkvetch *A. lentiginosus* var. *sesquimetralis*	Moist, open, alkaline hummocks and drainages near cool springs	Potential habitat present; not observed during surveys
Tonopah milkvetch *A. pseudiodanthus*	Deep loose sandy soils of stabilized and active dune margins, old beaches, valley floors, or drainages, in salt desert shrub	Potential habitat present; not observed during surveys
Sand cholla *Grusonia pulchella*	Sand of dunes, dry-lake borders, river bottoms, washes, valleys, and plains on sandy soils	One individual was observed in Inter-Mountain Basins Mixed Salt Desert Scrub habitat along the northern gen-tie alignment.
Sagebrush pygmyleaf *Leoflingia squarrosa* ssp. *aretemisiarum*	Fine, deep, often granitic, sandy soils of valley flats and dunes in the sagebrush and possibly mixed-shrub zones, usually in openings among sagebrush	Potential habitat present; not observed during surveys
Tiehm blazingstar *Mentzelia tiehmii*	White, alkaline, clay badlands and flats	Potential habitat present; not observed during surveys

Species	Habitat	Potential for Occurrence
Oryctes *Oryctes nevadensis*	Deep, loose sand of stabilized dunes, washes, and valley flats, on various slopes and aspects; appears only in years with optimal rainfall and temperature patterns	Potential habitat present; not observed during surveys
Nevada dune beardtongue *Penstemon arenarius*	Deep, volcanic, sandy soils; common associates include fourwing saltbush, littleleaf horsebrush, and greasewood	Potential habitat present; not observed during surveys.
Lahontan beardtongue *P. palmeri* var. *macranthus*	Along washes, roadsides, and canyon floors, particularly on carbonate-containing substrates, usually where subsurface moisture is available throughout most of the summer	Potential habitat present; not observed during surveys
Playa phacelia *P. inundata*	Grows in alkali playas and seasonally inundated areas with clay soils	Potential habitat present; not observed during surveys
Invertebrates		
Carson valley wood nymph *Cercyonis pegala carsonensis*	Wet meadows	Potential to occur
Pallid wood nymph[1] *C. oetus pallescens*	Alkaline flats	Potential to occur
Dixie Valley pyrg *Pyrgulopsis dixensis*	Spring habitats in the Dixie Valley	Has not been documented in Dixie Meadows though suitable habitat is present in Dixie Meadows. Documented elsewhere in Dixie Valley.
Carson Valley silverspot *Speyeria nokomis carsonensis*	Permanent spring-fed meadows, seeps, marshes, and boggy, streamside meadows associated with flowing water; with adequate supply of the larval food plant (bog violet [*Viola nephrophylla*])	No violet species observed in the study area; suitable habitat may be present in Dixie Meadows
Amphibians		
Dixie Valley toad *Anaxyrus boreas*	Springs, seeps, streams, and similar wet areas. Endemic to Dixie Valley	Documented in Dixie Meadows
Northern leopard frog *Rana pipiens*	Springs, slow streams, marshes, bogs, ponds, floodplains, reservoirs, and lakes; usually permanent water with rooted aquatic vegetation	Not documented in Dixie Meadows, however, suitable habitat exists in Dixie Meadows.
Birds		
Burrowing owl *Athene cunicularia*	Treeless areas with low vegetation and burrows	Potential to occur; detected within 1 mile of survey area
Golden eagle *Aquila chrysaetos*	Variety of open and semi-open landscapes, with sufficient mammalian prey base and cliff sites for nesting	Confirmed; several nests observed in the surrounding mountains
Ferruginous hawk *Buteo regalis*	Grasslands and semi-desert shrublands; nests in isolated trees, on rock outcrops, or on the ground	Potential to occur

Species	Habitat	Potential for Occurrence
Swainson's hawk *B. swainsoni*	Usually occurs close to riparian or other wet habitats; forages over agricultural fields, wet meadows, or open shrublands	Potential to occur
Greater sage-grouse *Centrocercus urophasianus*	Foothills, plains, and mountain slopes where sagebrush is present, often with a mixture of sagebrush and meadows close by	Northern gen-tie alignment traverses approximately 2.65 miles of OHMA; NDOW identified three pending[2] leks in the vicinity of the project area: the Fish Creek Basin 2, 5, and 6 leks. The nearest lek is on private land approximately 3.8 miles from the northern gen-tie alignment in Jersey Valley; the other leks are on BLM-administered lands approximately 4.5 and 5 miles from the northern gen-tie alignment in Jersey Valley.
Western snowy plover *Charadrius alexandrinus nivosus*	Alkali flat, mudflat, or flat beach next to permanent or seasonal surface water	Potential to occur. Observed within Dixie Meadows during 2009 surveys
Peregrine falcon *F. peregrinus*	Nests on ledge or hole on face of rocky cliff or crag; forages over various open habitats	Potential to occur; suitable foraging habitat present; suitable nesting habitat present in adjacent mountain ranges. Staff at NAS Fallon have observed this species in the Dixie Valley Settlement Area.
Bald eagle *Haliaeetus leucocephalus*	Nests in tall trees near bodies of water that support primary food sources: fish, waterfowl, and seabirds. Wintering areas are commonly associated with open water though in some regions (e.g., Great Basin), some bald eagles use habitats with little or no open water (e.g., montane areas) if upland food resources (e.g. rabbit or deer carrion and livestock afterbirths) are readily available.	No suitable nesting habitat present, potential to winter in the project area. No bald eagle nests have been documented within 10 miles of the project area (WRC 2013).
Loggerhead shrike *Lanius ludovicianus*	Open country, with scattered trees and shrubs, desert scrub; nests in shrubs or small trees	Observed along the northern gen-tie route
Sage thrasher *Oreoscoptes montanus*	Breeds in arid or semiarid sagebrush plains; in winter, uses arid and semiarid scrub, brush, and thickets	Potential to occur
Brewer's sparrow *Spizella breweri*	Strongly associated with sagebrush, in areas with scattered shrubs and short grass; in migration and winter, uses low, arid vegetation, desert scrub, sagebrush, and creosote bush	Potential to occur

Species	Habitat	Potential for Occurrence
Mammals		
Pallid bat *Antrozous pallidus*	Arid deserts and grasslands, often near rocky outcrops and water	Maternity and hibernation roost in Jersey Valley, approximately 3,000 feet (0.6 miles) from northern gen-tie route. Potential foraging habitat; documented by NDOW in project vicinity; documented in Dixie Meadows during acoustic surveys
Townsend's big-eared bat *Corynorhinus townsendii*	Maternity and hibernation colonies typically in caves and mine tunnels	Maternity roost in Jersey Valley, approximately 3,000 feet (0.6 miles) from northern gen-tie route. Potential foraging habitat; documented by NDOW in project vicinity
Big brown bat *Eptesicus fuscus*	Various wooded and semi-open habitats, including in cities	Foraging habitat present
Spotted bat *Euderma maculatum*	Various habitats, from desert to montane, including canyon bottoms, and open pastures	Foraging habitat present
Silver-haired bat *Lasionycteris noctivagans*	Prefers forested areas next to lakes, ponds, and streams	Foraging habitat present; documented in Dixie Meadows during acoustic surveys
Western red bat *Lasiurus blossevillii*	Riparian habitats in forests and woodlands, from lowlands up through mixed conifer forests of mountains; foraging habitat includes grasslands, shrublands, open woodlands and forests, and croplands	Foraging habitat present
Hoary bat *L. cinereus*	Prefers deciduous and coniferous forests and woodlands	Foraging habitat present; documented in Dixie Meadows during acoustic surveys
Small-footed myotis *Myotis ciliolabrum*	Desert, badland, and semiarid habitats	Foraging habitat present; documented by NDOW in project vicinity; documented in Dixie Meadows during acoustic surveys
California myotis *M. californicus*	Western lowlands; canyons, riparian woodlands, desert scrub, and grasslands	Foraging habitat present; documented in Dixie Meadows during acoustic surveys
Long-eared myotis *M. evotis*	Mostly forested areas; also shrubland, along wooded streams, over reservoirs	Foraging habitat present; documented by NDOW in project vicinity
Little brown myotis *M. lucifugus*	Adapted to using human-made structures; also uses caves and hollow trees	Foraging habitat present

Species	Habitat	Potential for Occurrence
Fringed myotis *M. thysanodes*	Desert, grassland, and wooded habitats	Foraging habitat present
Long-legged myotis *M. volans*	Primarily in montane coniferous forests; also in riparian and desert habitats	Foraging habitat present; documented on Navy lands near the Dixie Valley Settlement Area
Yuma myotis *M. yumanensis*	Wide variety of upland and lowland habitats, including riparian, desert scrub, moist woodlands, and forests, usually near open water	Foraging habitat present; documented by NDOW in project vicinity; documented in Dixie Meadows during acoustic surveys
Brazilian free-tailed bat *Tadarida brasiliensis*	Roosts primarily in caves	Foraging habitat present; documented in Dixie Meadows during acoustic surveys
Western pipistrelle bat *Pipistrellus hesperus*	Deserts and lowlands, desert mountain ranges, desert scrub flats, and rocky canyons	Foraging habitat present; documented by NDOW in project vicinity; documented in Dixie Meadows during acoustic surveys
Pygmy rabbit *Brachylagus idahoensis*	Occurs throughout much of the Great Basin in areas of tall, dense sagebrush (*Artemisia* spp.) or mixed sagebrush habitats. Pygmy rabbit burrows are typically found in relatively deep, loose soils of wind- or water-born origin suitable for burrowing.	No pygmy rabbits, burrows, scat, or tracks were observed during surveys. No suitable habitat present in the project area. Pygmy rabbit has been observed in suitable habitat in the vicinity of the project area.[3]
Dark kangaroo mouse *Microdipodops megacephalus*	In loose sands and gravel; found in shadscale scrub, sagebrush scrub, and alkali sink plant communities	Potential to occur
Pale kangaroo mouse *M. pallidus*	Restricted to fine sands in alkali sink and desert scrub dominated by shadscale or big sagebrush; often burrows in areas of soft, windblown sand, piled at the bases of shrubs	Potential to occur, especially along southern gen-tie ROW
Desert bighorn sheep *Ovis canadensis nelsoni*	Steep slopes on or near mountains, with a clear view of surrounding area	Suitable habitat in the Stillwater Range, next to Dixie Valley; no suitable habitat in the project area.

Sources: EMPSi 2016; NNHP 2016; NDOW 2016; BLM 2017

[1] This species was removed from the 2017 BLM Nevada Sensitive Species List, but it is retained here since it was analyzed in the draft EA.
[2] A pending lek is one without consistent breeding activity during the prior 3–5 surveys, or that has not been surveyed during the past 5 years.
[3] Email from Angelica Rose, BLM, to Drew Vankat, EMPSi, on September 2, 2016, regarding Dixie Meadows Comments

Plants

EMPSi biologists surveyed the project area and a 250-foot buffer for sensitive plant species in May 2011. In June 2016, they surveyed additional portions of the project area not covered by the 2011 surveys due to gen-tie alignment modifications. A full description of the survey method and agency coordination is in the Biological Survey Report (EMPSi 2016; see **Appendix D**).

One sensitive plant species was observed in the survey area in 2016, a sand cholla (*Grusonia pulchella*) growing in mixed salt desert scrub, along the proposed transmission alignment in the northern Dixie Valley (see Figure 4 in **Appendix D**). Soils at the site are somewhat alkaline sandy silts, with a moderately high biological crust cover, indicating marginal habitat for this species. The plant was not blooming, despite surveys being conducted during the blooming period, as indicated by the Nevada Natural Heritage Program (NNHP). No withered flowers or fruit were observed on the plant, indicating that it may not have bloomed in 2016.

Additional species that have not been observed in the project area vicinity but that have potential to occur in the project area based on presence of potentially suitable habitat are discussed below.

Sodaville milkvetch (*Astragalus lentiginosus* var. *sesquimetralis*) is a perennial herb in the pea family that grows in moist, open, alkaline hummocks and drainages near cool springs with saltgrass, greasewood, and other associated species (NNHP 2001). Potential habitat for this species occurs in the Dixie Meadows.

Tonopah milkvetch (*Astragalus pseudiodanthus*) is a perennial herb in the pea family that grows in deep, loose, sandy soils of stabilized and active dune margins, old beaches, valley floors, or drainages, with greasewood and other salt desert shrub species (NNHP 2001). Potential habitat for this species occurs in sandy soils especially along the southern gen-tie route.

Sagebrush pygmyleaf (*Loeflingia squarrosa* ssp. *artemisiarum*) is an annual herb in the pink family that grows in fine, deep, often granitic, sandy soils of valley flats and dunes in the sagebrush and possibly mixed-shrub zones, usually in openings among sagebrush (NNHP 2001). Potential habitat for this species occurs in sagebrush vegetation along the northern gen-tie route.

Tiehm blazingstar (*Mentzelia tiehmii*) is a perennial herb in the Loasaceae family that grows in white, alkaline clay badlands and flats (NNHP 2001). Potential habitat for this species may occur in the foothills of the adjacent ranges.

Oryctes (*Oryctes nevadensis*) is an annual herb in the nightshade family that grows in deep, loose sand of stabilized dunes, washes, and valley flats, on various slopes and aspects (NNHP 2001). Potential habitat for this species occurs in sandy soils especially along the southern gen-tie route.

Nevada dune beardtongue (*Penstemon arenarius*) is a perennial herb in the figwort family that grows in deep, loose, sandy soils of valley bottoms, wind-blown deposits, and dune skirts, often in alkaline areas, sometimes on road banks and other recovering disturbance areas in such soils, in the shadscale zone (NNHP 2001). Potential habitat for this species occurs throughout the project area in sandy soils. During the biological survey, potentially suitable habitats for this species were searched on foot; however, this species was not observed.

Lahontan beardtongue (*Penstemon palmeri* var. *macranthus*) is a sensitive species that occurs in washes, along roadsides, and on canyon floors, particularly on carbonate-containing substrates, usually where subsurface moisture is available throughout most of the summer. It has been documented in the vicinity of the project area, in Dixie Valley on the lower slopes of the Stillwater Mountains (NNHP 2016). During the biological survey, potentially suitable habitats for this species were searched on foot; however, this species was not observed.

Playa phacelia (*Phacelia inundata*) is an annual herb in the waterleaf family that grows in alkali playas and seasonally inundated areas with clay soils (NNHP 2001). Potential habitat for this species occurs in the Dixie Meadows and on other playa areas in the Dixie Valley.

All cactus species are protected by Nevada statute. At two sites, fragmentary dried remains of Plains beavertail cactus (*Opuntia polyacantha*) were found: one plant site was evidenced by a small pile of long spines; the other was evidenced by a fragment of the distinctive perforated wood that is formed by species in the genus *Opuntia*. Based on the appearance of dead plants of beavertail observed elsewhere, these plants likely died at least 2 years ago and probably much longer (ESRS 2013). No cactus species besides the single sand cholla individual discussed above were observed in the northern gen-tie alignment route.

Invertebrates

Dixie Valley Pyrg

Dixie Valley pyrg (*Pyrgulopsis dixensis*) is a sensitive springsnail that is known to occur in spring habitats only in Dixie Valley (NNHP 2016). NNHP lists this species as at-risk globally and critically imperiled. It was first collected in 1991 in springs in Dixie Valley, Pershing County (Township 25 North, Range 39 East; Hershler 1998), approximately 29 miles north of Dixie Meadows. Surveys of springs in Dixie Meadows in the project area did not locate this species (Springs Stewardship Institute 2018a *in* Stantec 2019), though the area was not intensively searched.

Very little is known about the life history of Nevada's endemic gastropods; little information on population numbers or the level of existing survey efforts exists for this species. Specific information on the life history of this species is not available, but in general *Pyrgulopsis* snails are short lived, surviving only 1 year, and reproduce only once before death (Frest and Johannes 1995). In general, these snails are essentially immobile and do not venture far from their place of birth. Springs and seeps comprising potentially suitable habitat for Dixie Valley pyrg are depicted in Figure 5, Seeps and Springs, of the ARMMP.

Species in the genus *Pyrgulopsis* are particularly susceptible to extinction, because the entire population of any single species is often tied to a single spring. Such sites may be no more than a few square meters and easily destroyed by water diversion, capping, groundwater pumping, invasive or exotic species, development, or livestock trampling. Even within an individual spring system the suitable habitat for and distribution of endemic gastropods may be limited to unique, small micro-habitats because of distance from the spring source, thermal and substrate characteristics, velocity, and other factors. Hence, these species may be particularly sensitive to disturbance and site alteration even when they include only a small part of a spring system (Wildlife Action Plan Team 2012).

ORNI 32 conducted springsnail (*Pyrgulopsis* spp.) surveys in October 2018 (Stantec 2019) and September and October 2020 (McGinley & Associates 2020) in Dixie Meadows. In 2018, between 7 and 15 individual snails were collected at 5 of 46 springs that were surveyed; all collections were submitted for deoxyribonucleic acid (DNA) analysis. Collections from three springs were determined to represent the genus *Pyrgulopsis*. Genetic sequences for two specimens, were found to be most similar to three previously described species including the Pleasant Valley pyrg (*Pyrgulopsis aurata*), the Cortez Hills pebblesnail (*Pyrgulopsis bryantwalkeri*), and the Ovate Cain Spring pyrg (*Pyrgulopsis pictilis*). Genetic sequences for two specimens from the third spring collection indicate similarity to the Surprise Valley pyrg (*Pyrgulopsis gibba*). Four specimens collected were sequenced with results being most similar to members of the pond snail family (Lymnaeidae) including *Fossaria* spp., *Lymnaea schirazensis*, and the dwarf pondsnail (*Galba truncatula*).

In 2020, ORNI 32 conducted a second springsnail survey to collect additional baseline data on abundance, distribution, and habitat characteristics. *Pyrgulopsis* spp. were encountered in the same springs as in 2018, plus an additional two springs. Also, five new springs were found during the 2020 springsnail survey. Detailed distribution, abundance, temperature, habitat, and stage data were collected at all five occupied springs (McGinley & Associates 2020). Springsnail distribution in occupied springbrook habitat appeared primarily driven by water temperature, with individuals occupying habitat within a narrow temperature range. The mean number of springsnails captured during sampling ranged from 0.3 to 17.5 individuals.

Additional sensitive invertebrate species could potentially occur within the project area based on literature reviews and a habitat assessment. Little published literature is available regarding the ecology of some of these species, which makes the likelihood of occurrence determination uncertain. Additionally, some of the species are known only from specific locations, such as isolated springs or dune habitats, lessening the likelihood of their occurrence in the project area.

Carson Valley Wood Nymph

Carson Valley wood nymph (*Cercyonis pegala carsonensis*) occurs in wet meadows in the Carson Valley; the larval host plant is unknown (WildEarth Guardians 2010). Suitable habitat may occur in the Dixie Meadows; however, this subspecies is not known to occur east of the Carson Valley, so the potential for occurrence in the project area is limited.

Pallid Wood Nymph

Pallid wood nymph (*Cercyonis oetus pallescens*) occurs in alkaline flats habitat. It has been documented in Churchill County. Suitable habitat for this species may occur in the Dixie Meadows or other alkaline flats habitat in the Dixie Valley.

Carson Valley Silverspot

Carson Valley silverspot (*Speyeria nokomis carsonensis*) occurs in permanent spring-fed meadows, seeps, marshes, and boggy, streamside meadows associated with flowing water and adequate supply of the larval food plant, bog violet (*Viola nephrophylla;* WildEarth Guardians 2010). No violet species have been observed in the project area. However, suitable habitat may occur in the Dixie Meadows.

Monarch Butterfly

Monarch butterfly (*Danaus plexippus plexippus*) is a candidate species for listing under the ESA (85 *Federal Register* 81813). Distribution is widespread but scattered. It requires milkweed (family Asclepiaecae) as host plants for larvae. Milkweeds readily grow along roadsides, in previously disturbed areas, and in native vegetation communities. Narrowleaf milkweed (*Asclepias fascicularis*) has been observed in the project area (see **Appendix D**) in wetland and riparian habitats in Dixie Meadows.

Amphibians

Northern Leopard Frog

The northern leopard frog is a medium-size spotted frog that occurs in the vicinity of springs, slow streams, marshes, bogs, ponds, canals, floodplains, reservoirs, and lakes; usually they are in or near permanent water with rooted aquatic vegetation (NatureServe 2015). The northern leopard frog could occur in the emergent marsh habitat in Dixie Meadows, where suitable habitat for this species is present. However, the NDOW has not recorded the northern leopard frog in Dixie Meadows (WRC 2013), and surveys on Navy lands in the Dixie Valley (Rose et al. 2015; NAS Fallon 2008) did not document any species in Dixie Meadows. Surveyors believed it is highly unlikely that the northern leopard frog was present on these lands at the time of surveys (Rose et al. 2015).

Dixie Valley Toad

On September 18, 2017, the USFWS received a petition from the Center for Biological Diversity requesting that the Dixie Valley toad be listed as threatened or endangered under the ESA (Center for Biological Diversity 2017). The main threat described in the petition is geothermal development proposed at Dixie Meadows, including the proposal in this EA (see **Chapter 2**). The risk of diseases such as *Batrachochytrium dendrobatidis* (*Bd*) fungus, found among bullfrogs in Dixie Valley, can also contribute to population declines. The disease, which affects over 700 species of amphibians, is thought to be responsible for 90 possible extinctions and the threatened status of over 500 amphibian species (Scheele et al. 2019). On June 27, 2018, the USFWS determined that the petitioned actions may be warranted, and initiated a status review to determine whether listing under the ESA is warranted.[20] At the conclusion of the status review, the USFWS would issue a finding, in accordance with Section 4(b)(3)(B) of the ESA, as to whether listing is warranted.

Gordon et al. (2017) described a new species of toad from the Great Basin region of northern Nevada belonging to the western toad (*Bufo* (*Anaxyrus*) *boreas*) species complex. The Dixie Valley toad (*Bufo* [*Anaxyrus*] *williamsi*) is distinguishable from western toad by a combination of diagnostic morphological characters, genetic evidence (Forrest et al. 2017), and localized distribution; it is restricted to an area less than approximately 1,500 acres in Dixie Valley (Gordon et al. 2017), including within portions of the project area on Navy and BLM-administered lands.

The Dixie Valley toad is found only within wetlands fed from artesian springs on the western edge of the Dixie Valley playa. There are no usable dispersal corridors to other potentially suitable habitat outside Dixie Valley. Four occupied spring discharge sites and an associated wetland marsh habitat are separated from each other and interrupted by sagebrush steppe. The toads are typically found in shallow water or associated with moist soils within the immediate perimeter of the riparian areas that border the surrounding sagebrush steppe (Gordon et al. 2017).

According to findings from the USGS (Halstead et al. 2021), even when in terrestrial environments, observations in spring and fall demonstrate that Dixie Valley toads are typically no farther than 45 feet from aquatic environments. This suggests the species' strong association with the marshes in the outflows of thermal springs in the Dixie Valley. The species' preference for water is strongest in males during brumation,[21] which begins in the fall (Halstead et al. 2021).

[20] https://www.regulations.gov/docket?D=FWS-R8-ES-2018-0018.

[21] A hibernation-like state that cold-blooded animals enter during the fall and winter

Similar to most toads in the western toad complex, the Dixie Valley toad is typically nocturnal, emerging at dusk, and can be found in moist vegetation or in very still, shallow water with very little vegetation canopy. In autumn, the Dixie Valley toad selects sites to overwinter in a dormant state of brumation in areas with stable water temperatures; they emerge in spring to breed (Gordon et al. 2017; Halstead et al. 2021). Breeding occurs from March to June (Forrest et al. 2013). Egg masses and tadpoles develop in still, shallow water within the margins of the marsh habitat, where there are adequate temperatures for development (Karlstrom 1962; Carey et al. 2005). Toadlets are generally fully metamorphosed in approximately 10 weeks (Forrest et al. 2013).

Little is known regarding dispersal and non-breeding behavior of the Dixie Valley toad. Studies examining the non-breeding movements of western toads have shown that toads can use habitats up to 1.25 miles from breeding ponds (Muths 2003; Bartelt et al. 2004; Bull 2006); however, these studies were conducted in higher-elevation, cooler, moister, forested landscapes in the western United States. While the Dixie Valley toad uses uplands surrounding occupied wetlands in Dixie Valley, warming spring temperatures and an affinity for water limit its home range to areas generally within 45 feet from wetlands (Halstead et al. 2021).

The Dixie Valley toad generally prefers locations with water that is warmer than surrounding areas. Halstead et al. (2021) found that larval toads preferred warmer water temperatures than adults.

The overall population numbers of this toad are also unknown; however, the current range is severely restricted. This suggests that this species' population is likely very small (Gordon et al. 2017).

Dixie Valley toads were frequently encountered on Navy lands by surveyors in Dixie Meadows in 2011. Documentation of all life stages of these toads in the Dixie Meadows wetlands indicated successful recruitment in 2011 (Rose et al. 2015). Due to extremely limited recapture rates of tagged toads, accessibility issues, and insufficient resources, no accurate estimates of overall population abundance and structure are currently available (Forrest et al. 2013). The NDOW conducts annual surveys for this species and has previously pit tagged approximately 200 toads to assist with monitoring the population size in Dixie Meadows.[22]

The Dixie Valley toad faces several potential threats stemming from its extremely limited distribution. Habitat modification from the global climate (Forrest et al. 2013) could reduce essential breeding habitat. Geothermal energy development in the Dixie Valley could alter the water quality, temperature, supply, or flow in its habitat (Forrest et al. 2013).

[22] Kris Urquhart, NDOW, discussions with Melanie Cota, BLM, in 2016, regarding Dixie Valley toad.

Dixie Valley toads are susceptible to other threats, particularly disease. In 2011 and 2012, Dixie Valley toads and other nearby amphibian populations of western toads and American bullfrogs were tested for *Bd*. None of the Dixie Meadows or western toads sampled were positive for *Bd*. American bullfrogs are a known vector for *Bd*; the high incidence of the fungus among this nearby population of bullfrogs in Dixie Valley may represent a serious threat to Dixie Valley toads (Forrest et al. 2013).

Birds

Greater Sage-Grouse

Greater sage-grouse use a wide variety of sagebrush mosaic habitats with meadows and aspen (*Populus* spp.) in close proximity. This species roosts in sagebrush and also uses seeps, wet meadows, riparian areas, alfalfa fields, potato fields, and other cultivated and irrigated areas. Leks are located on relatively open sites surrounded by sagebrush, or in areas where sagebrush density is low, such as exposed ridges, knolls, or grassy swales (Schroeder et al. 1999). Nests are located in thick cover in sagebrush habitat and consist of a shallow depression on the ground.

The most significant threats to greater sage-grouse in Nevada are natural system modifications due to wildfire and the subsequent loss of habitat combined with impacts of invasive species (e.g., cheatgrass) and problematic native species encroachment (e.g., pinyon-juniper woodlands). Habitat fragmentation and disturbance is also a threat, particularly from roads and utility service lines as a result of both renewable and nonrenewable energy resources. Habitat degradation caused by improper grazing, recreational activities, and loss of upland meadows to mining are also threats (Wildlife Action Plan Team 2012).

In September 2015, the USFWS determined the greater sage-grouse does not face the risk of extinction in the foreseeable future and does not warrant protection under the ESA. The decision was largely based on the comprehensive avoidance and mitigation strategy reflected in the revised BLM and Forest Service land management plans. The USFWS will regularly evaluate its listing decision based on new science.

In a letter dated May 29, 2013, NDOW stated that there are no known greater sage-grouse lek sites in the vicinity of the project area, and that greater sage-grouse habitat in the project area is primarily categorized as unsuitable habitat. Surveys in 2013 (WRC 2013) did not observe suitable habitat for greater sage-grouse in the project area, and did not observe individuals or sign, including scat, feathers, egg shells, or tracks (WRC 2013). However, the habitat mapping process for the 2015 Greater Sage-Grouse management plan amendment (BLM 2015a) classified portions of the project area, including a portion of the areas traversed by the northern gen-tie route, as OHMA. Approximately 14,000 linear feet (2.65 miles) of the northern gen-tie route traverses greater sage-grouse OHMA (BLM GIS 2016). NDOW also identified greater sage-grouse OHMA as described above (NDOW 2016).

In 2019, the BLM released the *Nevada and Northeastern California Greater Sage-Grouse RMP Amendment*, which updated the 2015 Greater Sage-Grouse habitat maps (BLM 2019a). In October 2019, the US District Court for the District of Idaho issued a preliminary injunction that suspends implementation of the 2019 *Greater Sage-Grouse RMP Amendment*, including in Nevada and Northeastern California. As a result, the 2015 *Greater Sage-Grouse RMP Amendment*, including the habitat mapped therein, remains in effect until the injunction is resolved.

During additional coordination with NDOW, the agency identified three pending leks in the vicinity of the project area: the Fish Creek Basin 2, 5, and 6 leks.[23] These pending leks, which have not had observed breeding activity during the prior 5 years or have not been surveyed in the past 5 years, are in the Fish Creek and Cottonwood Basins, on the east side of the Fish Creek Mountains. The nearest lek is on private land (approximately 3.8 miles from the northern gen-tie alignment in Jersey Valley); the other leks are on BLM-administered lands approximately 4.5 and 5 miles from the northern gen-tie alignment in Jersey Valley. For leks, the BLM *Nevada and Northeastern California Greater Sage-Grouse RMP Amendment* (BLM 2019a) identifies a preferred 3-mile buffer distance from tall structures, such as transmission lines.

The Nevada Sagebrush Ecosystem Technical Team (SETT) used the Nevada Greater Sage-Grouse Habitat Quantification Tool (HQT) to quantify habitat function for greater sage-grouse along the northern gen-tie route. The HQT quantifies habitat function for a range of purposes, including a determination of potential temporary and permanent impacts of a project on potential sage-grouse habitat and a calculation of debits generated by the project under the Nevada Conservation Credit System (State of Nevada 2016). The SETT completed an initial HQT desktop assessment in October 2020. ORNI 32 plans to field-verify results of the northern gen-tie HQT desktop assessment prior to project implementation. A HQT assessment has not been completed for the southern gen-tie alignment because it is not within currently identified greater sage-grouse habitat.

Golden Eagle

Golden eagles are generally found in open country, prairies, arctic and alpine tundra, open wooded country, and barren areas, especially in hilly or mountainous regions. In Nevada, they nest predominantly on rock ledges on cliffs and occasionally in large trees. Pairs may have several alternate nests and may use the same nest in consecutive years or shift to an alternate nest in different years. The species is vulnerable to reduction of prey populations due

[23] Mark Freese, NDOW, email to Morgan Trieger, EMPSi, on October 6, 2016, regarding greater sage-grouse NDOW data request response - additional leks.

to degradation or loss of rangelands to development, wind turbine collisions, and potential disturbance causing nest abandonment (Wildlife Action Plan Team 2012).

Aerial surveys for golden eagle were conducted within 4 miles of the geothermal lease areas and northern gen-tie route in 2011 (EMPSi 2016). Survey buffers were determined following USFWS guidance for similar geothermal utilization projects in the Coyote Canyon and New York Valley Geothermal Resource Areas[24] and were approved by the BLM.[25] Golden eagle aerial surveys were conducted using the protocols outlined in the Interim Golden Eagle technical guidance (Pagel et al. 2010) and were conducted via a Bell 206L-4 helicopter. Surveys were conducted on June 27 and 28, 2011. Nine active confirmed golden eagle nests (5 of which were occupied at the time of the survey) and 16 inactive nests were recorded within 4 miles of the geothermal lease area and northern gen-tie route. All nests were located in rock outcrops and on cliff faces in the ranges adjacent to Dixie Valley and Jersey Valley. Nest locations are shown in **Figure 9**, Raptor Nests.

The nearest active nest from the 2011 survey to any project component is located approximately 5,700 feet (1.1 miles) northwest of the geothermal lease boundary; this nest is located approximately 7,400 feet (1.4 miles) away from the proposed gen-tie. The nearest inactive nest from the 2011 survey is located 6,050 feet (1.2 miles) from the geothermal lease boundary and approximately 8,300 feet (1.6 miles) from the northern gen-tie (Ormat GIS 2016).

In addition, five adult golden eagles, five young-in-nest eagles, and one fledgling were observed during the aerial golden eagle survey. Additional details on observations are provided in the biological survey report (EMPSi 2016; **Appendix D**). Several other raptors were also incidentally observed. These include prairie falcon, turkey vulture, red-tailed hawk, ferruginous hawk (probable), and American kestrel. Surveyors noted that one observed inactive nest could have been a prairie falcon nest.

Ground surveys for golden eagle were conducted within the geothermal lease areas and the southern gen-tie route and within a 1-mile buffer of this route between June and August 2013 (WRC 2013). Per consultation with NDOW, eight golden eagle nests occurred within 10 miles of the southern gen-tie route (WRC 2013). The NDOW provided an Excel table of UTM coordinates for these nest locations. Coordinates were plotted, and all nests within the 1-mile buffer were assessed for active or inactive status during the field surveys. One active nest was observed within the 1-mile buffer in the Louderback Mountains,

[24] Steve Abele, USFWS, email to Sue Fox, WRC, on November 17, 2010, regarding the goea [golden eagle] – again.
[25] John Wilson, BLM, email to Meredith Zaccherio, EMPSi, on June 6, 2011, regarding Dixie Hope golden eagle survey.

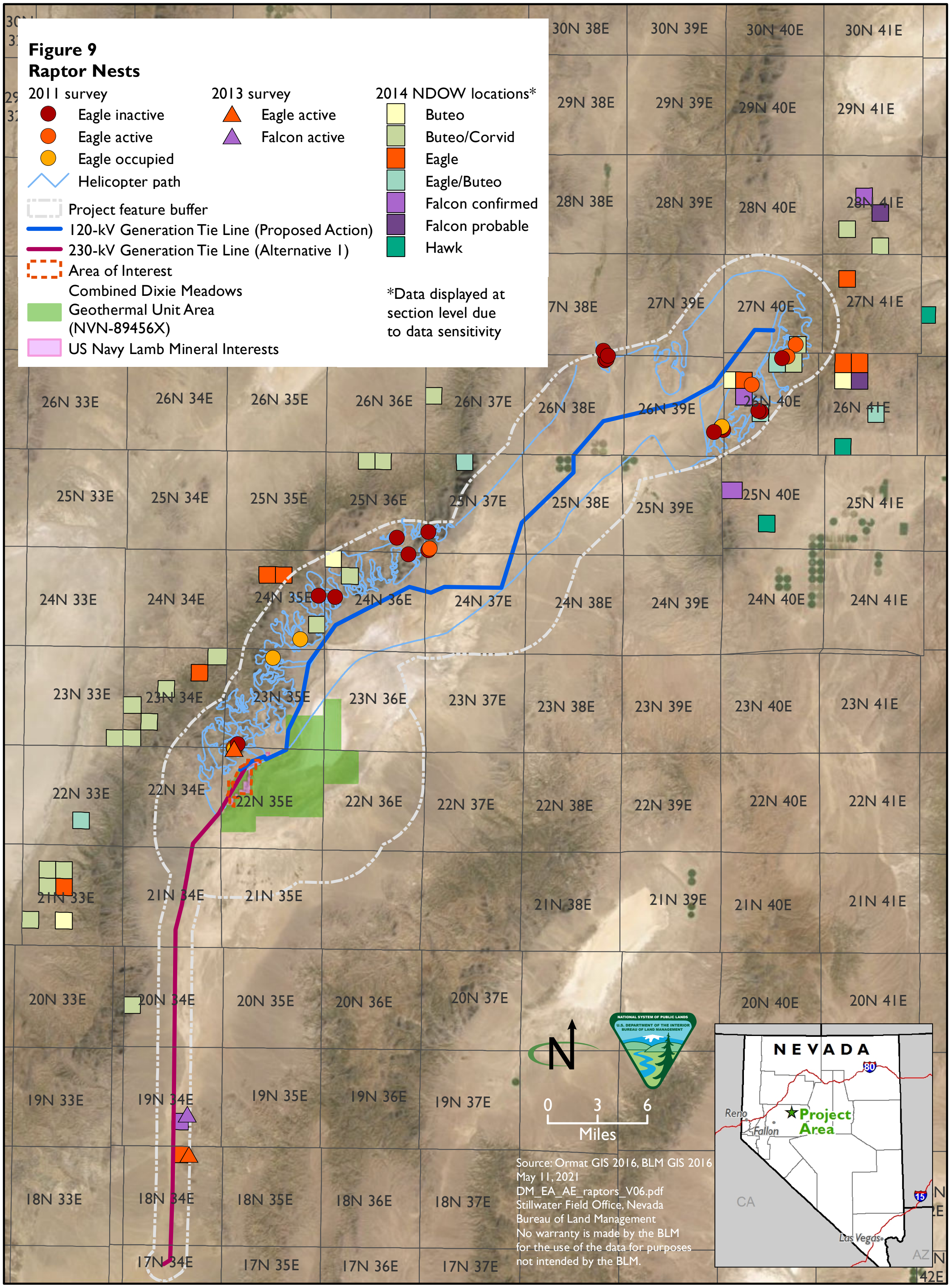
Figure 9
Raptor Nests
2011 survey
Eagle inactive
Eagle active
Eagle occupied
Helicopter path
2013 survey
Eagle active
Falcon active
2014 NDOW locations*
Buteo
Buteo/Corvid
Eagle
Eagle/Buteo
Falcon confirmed
Falcon probable
Hawk
Project feature buffer
120-kV Generation Tie Line (Proposed Action)
230-kV Generation Tie Line (Alternative 1)
Area of Interest
Combined Dixie Meadows Geothermal Unit Area (NVN-89456X)
US Navy Lamb Mineral Interests
*Data displayed at section level due to data sensitivity
N
0 3 6
Miles
Source: Ormat GIS 2016, BLM GIS 2016
May 11, 2021
DM_EA_AE_raptors_V06.pdf
Stillwater Field Office, Nevada
Bureau of Land Management
No warranty is made by the BLM for the use of the data for purposes not intended by the BLM.
NEVADA
Reno
Fallon
Project Area
CA
AZ
Las Vegas
80
15

approximately 4,940 feet (0.9 miles) from the southern gen-tie, and an additional active nest is located approximately 500 feet outside of the 1-mile buffer in the Stillwater Range (this nest was also active in 2011 and is located 5,700 feet [1.1 miles] northwest of the geothermal lease boundary; this nest is located approximately 7,400 feet [1.4 miles] away from the proposed gen-tie as described above).

Although NDOW identified an additional golden eagle nest within the 1-mile buffer, suitable nesting habitat is not present at this location (WRC 2013). In addition, one adult golden eagle was observed perched on an existing wooden power line pole in the southern portion of the southern gen-tie alignment.

Ground surveys for golden eagle were also conducted within the geothermal lease areas and portions of the northern gen-tie route and within a 1-mile buffer of these areas in June 2016 (EMPSi 2016). No golden eagles or nests were observed during the 2016 ground survey.

In summary, the nearest active nest observed during all surveys to any project component is approximately 4,940 feet (0.94 miles); this nest is located in the Louderback Mountains east of the southern gen-tie route (see Figure C-2 in **Appendix C**). The nearest active nest to the lease areas and northern gen-tie route is located approximately 5,700 feet (1.1 miles) northwest of the geothermal lease boundary; this nest is located approximately 7,400 feet (1.4 miles) away from the northern gen-tie. The nearest inactive nest is approximately 6,050 feet (1.2 miles) from the geothermal lease boundary and approximately 8,300 feet (1.6 miles) from the northern gen-tie (Ormat GIS 2016). The USFWS generally recommends a 1-mile buffer around golden eagle nest sites for ground-based human activities. The USFWS determines actual buffer zones for individual projects based on the type of use and site characteristics (USFWS 2017).

Foraging habitat for golden eagles is present throughout the project area.

Ferruginous Hawk

Ferruginous hawk habitat includes open country, sagebrush, saltbush-greasewood shrubland, and the periphery of pinyon-juniper and other woodland and desert communities. In Nevada, ferruginous hawks nest primarily in live juniper trees, occasionally on tufa stacks and rock outcrops, sometimes on power line towers, and rarely on the ground (Wildlife Action Plan Team 2012). Suitable foraging and nesting habitat are present in the project area, and biologists reported a probable observation of the species during the aerial golden eagle survey (EMPSi 2016; **Appendix C**).

Swainson's Hawk

Swainson's hawk forages in savanna, open pine-oak woodland, and cultivated lands (e.g., alfalfa and other hay crops, and certain grain and row croplands) with scattered trees, usually near riparian areas. It nests typically in a solitary tree, bush, or small grove; sometimes it nests on rock ledges. Suitable foraging and nesting habitat is present in the project area.

Burrowing Owl

Burrowing owl optimum habitat is typified by short vegetation and the presence of recent, small mammal burrows. This species is found in open grasslands, sagebrush, and sagebrush-steppe, and sometimes in open areas such as vacant lots near human habitation. In Nevada, burrowing owl is vulnerable to habitat loss and fragmentation primarily due to urban land conversion, and habitat degradation from control and extermination of colonial burrowing mammals. It is also vulnerable to vehicle collisions, predators, disturbance, harassment by dogs, collapse of burrows, and alterations in food availability (Wildlife Action Plan Team 2012).

Burrowing owls may use a series of burrows and satellite dens during the nesting season. They are especially mobile after young reach approximately 3 weeks old; chicks may be moved between satellite dens at intervals of 10 to 14 days, presumably to reduce the potential for predation (Desmond and Savidge 1998).

Burrowing owls and their active burrows were observed in three locations during the 2011 surveys within one-half mile of the northern gen-tie; no burrowing owls were observed at these locations in 2016 (see Figure 4 in EMPSi 2016). In 2011, the entrance to burrow 1 had scat and a few pellets. An owl was perched at the burrow, and a second owl flew east from this location. As such, it is likely there is a pair nesting at this site. Burrow 2 is lined with cow scat and had no pellets, scat, white-wash, or feathers. It is adjacent to the main dirt road and is east of burrow 1. A single owl was observed perched on the dirt mound at burrow 3. Fresh pellets, scat, and white-wash were noted at the burrow entrance.

Burrowing owls can form loose nesting colonies, and it is possible there is a colony of burrowing owls in this area. Colonies often form where colonial ground squirrels are present due to the abundance of holes. However, the three burrows observed during the field survey were likely dug by badgers based on their shape, dimensions, and old nail marks on the side walls.

Inactive burrowing owl burrows were observed during surveys in 2016, but no owls were observed. Inactive burrows exhibited signs of past use by burrowing owls, including old pellets. No feathers or whitewash were observed at the burrows, and cobwebs and vegetation were partially covering burrow entrances (see Figure 4 in EMPSi 2016).

Biologists conducted burrowing owl surveys along the southern gen-tie alignment and within the lease areas in July 2013 (WRC 2013). There were no burrowing owls detected during the surveys.

Western Snowy Plover

Western snowy plovers are often seen on alkali playas near standing pools of shallow water. During times of drought they rely heavily on artesian wells and springs that spill water onto the dry playas. Snowy plovers generally nest on recently exposed alkaline flats (Paton and Edwards 1990). They are vulnerable to habitat loss from development and as a result of dewatering of playas or springs during the breeding season due to water diversions, drought, or the global climate (Wildlife Action Plan Team 2012). Western snowy plover may use playa habitat in the Dixie Valley for breeding and foraging. This species was documented in Dixie Valley in 2009.

Peregrine Falcon

Peregrine falcons forage in various open environments, including open water, desert shrub, and marshes, usually in close association with suitable nesting cliffs. When not breeding, they occur in areas where prey concentrate, including marshes, lake shores, rivers and river valleys, cities, and airports. In Nevada, peregrine falcons often nest on a ledge or in a hole on the face of a rocky cliff or crag (Wildlife Action Plan Team 2012). Suitable foraging habitat is present in the project area; suitable nesting habitat is present in adjacent mountain ranges. Staff at NAS Fallon have observed this species in the Dixie Valley Settlement Area.

Bald Eagle [Not present]

Bald eagle usually nests in tall trees or on cliffs near bodies of water that provide a food base. Nests located on cliffs and rock pinnacles also have been reported historically in Nevada. Bald eagle winters throughout Nevada; winter distribution is influenced by waterfowl concentrations or bodies of water (Wildlife Action Plan Team 2012). There is no suitable nesting habitat present in the project area, though potential wintering habitat may be present. No bald eagle nests have been documented within 10 miles of the project area (WRC 2013).

Loggerhead Shrike [Not present]

Loggerhead shrikes breed in open country with scattered trees and shrubs, savanna, desert scrub, and, occasionally, open woodland. They often perch on poles, wires, or fence posts, and suitable hunting perches are an important part of the habitat (Yosef and Grubb 1994). Loggerhead shrikes nest in shrubs or small trees (Wildlife Action Plan Team 2012). Several foraging loggerhead shrikes were observed during the 2016 surveys along the northern gen-tie alignment. No active or inactive nests were observed in the vicinity of the observations (see Figure 4 in EMPSi 2016).

Sage Thrasher

In the northern Great Basin, sage thrasher breeds and forages in tall sagebrush, sagebrush/juniper, mountain mahogany, and sagebrush/aspen communities (Maser et al. 1984). This species generally nests in sagebrush shrubs, in a branch fork near the ground. In winter, it uses arid and semi-arid scrub, brush, and thickets (Wildlife Action Plan Team 2012). Sage thrasher may use sagebrush habitat in the project area. It was not observed during the 2016 surveys.

Brewer's Sparrow
Brewer's sparrow is strongly associated with sagebrush, where it nests low in sagebrush shrubs (Wildlife Action Plan Team 2012). Brewer's sparrow may use sagebrush habitat in the project area. It was not observed during the 2016 surveys.

Mammals

Bats
Foraging habitat exists throughout the project area for sensitive bat species. Numerous species of bats have been acoustically detected in the Dixie Meadows area, as described below.

No bat roosting habitat, such as abandoned buildings, mine workings (e.g., shafts, adits, and inclines), trees, rock outcrops, or cliffs, is present in the immediate vicinity of project components; however, roosting habitat is present in numerous locations within a mile of project components, including the northern gen-tie. Such roosting habitat includes abandoned mine lands in the Jersey Valley, rock outcrops and cliffs in several locations, and live and dead riparian trees in Dixie Meadows, as described below.

The primary structural bat roosting habitat in the immediate vicinity of project components is the wooden power poles associated with the existing transmission line. Bats could potentially roost in these power poles if woodpecker holes are present. While not all power poles were surveyed, those that were scanned did not have any cavities. Moreover, no evidence of decay or rotting in the power poles, which could produce flaking or locations where bats could roost, was noted. It is likely that these poles are carefully maintained and if they began to decay, they would be replaced. Thus, although bats could forage over the shrubs found in the mixed salt desert scrub and greasewood habitats, the plants in this habitat type do not provide suitable long-term night and day roosting sites.

Bat acoustic detectors were deployed over two nights from July 7 to 8, 2013. Detectors were placed at several locations in Dixie Meadows within and east of the lease areas and near the southern end of the southern gen-tie alignment, as shown in WRC (2013). In the meadows, the detectors were placed along the periphery of the meadow near trees such as tamarisk and Russian olive, and near open water in channels and small ponds. Several bat species were detected in the Dixie Meadows locations; species detected were Brazilian free-tailed bat, California myotis, small-footed myotis, and western pipistrelle. No bats were detected in the lease areas or at the southern gen-tie detector locations (WRC 2013).

Suitable roosting habitat for bats is likely present outside the project area, within live and dead trees surrounding ponds in Dixie Meadows, within rock outcrops and abandoned mine workings in the adjacent Stillwater Range and Louderback Mountains, and within the Dixie Valley Settlement Area east of the southern gen-tie route in mature trees and old buildings (WRC 2013; EMPSi 2016).

Eight species of bats were recorded at Dixie Meadows during acoustic surveys performed in April and May 2007, according to the Ecological Inventory Update Naval Air Station Fallon Nevada August 2008. Besides the four species recorded during 2013 surveys, pallid bat, silver-haired bat, hoary bat, and Yuma myotis were also recorded (WRC 2013). In addition, the 2014 Final Integrated Natural Resource Management Plan and Environmental Assessment Naval Air Station Fallon, Nevada (NAS Fallon 2014) cites a 1997 ecological inventory that found long-legged myotis in old buildings in the Dixie Valley Settlement Pond Area.

The NDOM maintains a database of abandoned mine workings in the state. Coordination with the NDOM indicates that at least eight abandoned mine workings, including shafts, adits, and declines, are present within 0.6 miles (1 kilometer) of the project (NDOM 2016); the number of features tracked by the NDOM is higher along the northern gen-tie route than the southern gen-tie route. As discussed, these features may provide suitable roosting areas for bat species.

NDOW has documented several bat species near the project area. Species documented are pallid bat, Townsend's big-eared bat, California myotis, long-eared myotis, small-footed myotis, long-legged myotis, Yuma myotis, and western pipistrelle (NDOW 2016).

The NDOW also indicated that pallid bat and Townsend's big-eared bat maternity and hibernation roosts are present in Jersey Valley, near the northern gen-tie.[26] Roosts are present in abandoned mine lands, less than 500 feet from Ormat's Jersey Valley Geothermal Power Plant, at the terminus of the proposed northern gen-tie alignment. Several of the abandoned mine lands in this area have been gated to prevent human entry while allowing for bat use, but additional compatible closures are needed to protect maternity roosts.

Foraging habitat is present in the project area for big brown bat, spotted bat, western red bat, little brown myotis, and fringed myotis. However, these species have not been documented in or near the project area.

[26] Jenni Jeffers, NDOW, phone call with Morgan Trieger, EMPSi, on October 7, 2016, regarding biological resources.

Pygmy Rabbit

Pygmy rabbits are found primarily on big sagebrush dominated plain and alluvial fans where plants occur in tall, dense clumps (Green and Flinders 1980). Deep, friable, loamy-type soils are required for burrow excavation. They may occasionally use burrows excavated by other species (e.g., yellow-bellied marmot). Therefore, they may occur in areas that support shallower, more compact soils as long as sufficient shrub cover is available (USFWS 2010). Threats include livestock grazing, wildfire, invasive species, and the global climate (Wildlife Action Plan Team 2012). No pygmy rabbits, burrows, scat, or tracks were observed during the surveys. There is no suitable habitat in the project area. However, pygmy rabbits have been observed in suitable habitat in the vicinity of the project area in the Jersey Valley.

Kangaroo Mice

Both pale and dark kangaroo mice are sensitive species and Nevada protected mammals (NAC 503.030). These animals are associated with intermountain (cold desert) scrub habitat, which is the most common habitat type in the project area. In this habitat type, both species are found in shadscale, sagebrush, and alkali sink plant communities, which are present in the project area.

Both species are strongly associated with sandy soils. The pale kangaroo mouse may be more ecologically specialized than the dark kangaroo mouse (Hafner et al. 2008). It is typically restricted to deep, sandy soils with little or no gravel, usually below the sagebrush zone. The dark kangaroo mouse, on the other hand, is tolerant of a wide range of sandy substrates and vegetation associations.

Field surveys in the geothermal plant area and southern gen-tie ROW (WRC 2013) suggest that small-scale surface deposits of sand, indicative of pale kangaroo mouse habitat, were common in the southern portion of the southern gen-tie route. Also, there is a record from 1950 of the pale kangaroo mouse. It was recorded on Navy lands southwest of the project area, in the US Naval Electronic Warfare Training Area. Thus, the pale kangaroo mouse has the potential to occur, particularly in the southern portion of the project area. The dark kangaroo mouse, with more general habitat preferences, also has the potential to occur there.

Small mammals were not trapped in the project area as part of project surveys. Burrows typical of kangaroo rats (*Dipodomys* ssp.) were noted throughout the southern gen-tie route. One Heteromyidae rodent (an unidentified species of kangaroo rat) was observed during the field survey (WRC 2013). Kangaroo rats have no special federal status and are not a state or BLM-listed sensitive species.

Bighorn Sheep

Bighorn sheep occur in alpine to desert grasslands or shrub-steppe in mountains, foothills, or river canyons. Escape terrain (e.g., cliffs and talus slopes) is an important habitat feature (Wildlife Action Plan Team 2012). Bighorn sheep have been recorded in the Stillwater Range (EMPSi 2016), to the west of the project area. Suitable breeding habitat is limited to the higher, rocky portions of the adjacent ranges. However, the species may use portions of the project area for foraging or for access to water. Bighorn sheep could also use the project area if they were to disperse to the Clan Alpine Mountains on the east side of Dixie Valley, which is also occupied bighorn sheep habitat.

3.8.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)

Impacts on sensitive plant and wildlife species habitat from the Proposed Action would generally be the same as those described in **Section 3.5**, Migratory Birds; **Section 3.6**, Vegetation; and **Section 3.7**, Wildlife and Key Habitat. Impacts would be avoided or minimized by adherence to the EPMs and additional mitigation measures as described in these sections. Additional impacts on sensitive plant and wildlife species, as well as measures to avoid, reduce, or mitigate impacts, are described below.

Plants

Direct impacts on the sensitive plant species sand cholla could occur during construction of the northern gen-tie. Direct impacts could come from crushing, uprooting, or injuring the plant, potentially resulting in mortality or reduced reproductive success. Indirect impacts could occur if excessive dust mobilized during construction were to settle on the plant. This could suppress physiological processes or pollinator success.

Implementing the EPMs in **Appendix J**, including placing flagging or fencing around species and applying a 50-foot (or other appropriate buffer determined by the qualified botanist and the BLM) would avoid impacts on the sand cholla. If avoidance is not feasible, the BLM would determine mitigation, which could include transplantation, seed collection, grow out and plantings, or other methods described in **Appendix J** or as determined appropriate by the BLM.

Botanical surveys in the project area have not recorded any other sensitive plant species, although potential habitat exists for eight other sensitive plant species in and near the project area. These species are:

- Sodaville milkvetch
- Tonopah milkvetch
- Sagebrush pygmyleaf
- Tiehm blazingstar
- Oryctes
- Nevada dune beardtongue
- Lahontan beardtongue, and
- Playa phacelia

Full preconstruction surveys would be conducted prior to any surface disturbance for the project within potential habitat for these species. If any sensitive plant species are detected, they would be avoided by imposing buffers until construction is complete, using the methods for sand cholla avoidance described above. If avoidance is not possible, the BLM would determine the appropriate mitigation required for no net loss of the species. All natural processes that create and maintain sensitive species habitat shall be protected and preserved.

Population viability for any one species is not expected to be in jeopardy as a result of implementing the Proposed Action. This is due to the EPMs and additional mitigation measures for sensitive plant species in **Appendix J** (see **Section J.2.2**). In addition, the Proposed Action is not expected to contribute to the need for listing any sensitive species.

Direct impacts on sensitive plants that grow in wetland and riparian habitat are not anticipated. This is because construction would not occur in these areas. Indirect impacts on these plants or their habitat would be possible if geothermal utilization were to decrease the wetland vegetation extent or degrade the vegetation condition in Dixie Meadows. This could reduce the habitat quality for sensitive plants by altering soil moisture conditions and community composition, and increasing competition with nonnative, invasive plants. However, as described in additional detail in **Section 3.9.2**, adverse impacts on wetland or riparian habitat would be avoided, minimized, or mitigated by implementing the avoidance and mitigation measures in Table 12 of the ARMMP (**Appendix H**) and EPMs (**Appendix J**). As a result, impacts on sensitive wetland plants and their habitat are not anticipated to occur.

Invertebrates

Suitable habitat for sensitive butterflies, including the Carson Valley wood nymph, pallid wood nymph, and Carson Valley silverspot, may be present in Dixie Meadows. Larval host plant habitat for monarch butterfly is present in Dixie Meadows, and may be present along the gen-tie route. Direct impacts on sensitive butterflies and their host vegetation in Dixie Meadows are not anticipated to occur. This is because suitable habitat would be avoided during construction, including by routing the northern gen-tie route outside of wetland meadows in the northern portion of Dixie Meadows.

Indirect impacts on sensitive butterflies would be possible if geothermal utilization were to decrease the wetland vegetation extent or degrade the vegetation condition in Dixie Meadows. This could reduce habitat quality for sensitive butterflies by reducing available host or nectar vegetation. However, as described in additional detail in Section 3.9.2, significant adverse impacts on wetland or riparian habitat would be avoided, minimized, or mitigated by implementation of the measures described in Section 3.9 of the ARMMP (**Appendix H**). As a result, significant impacts on sensitive butterfly habitat are not anticipated to occur.

Indirect impacts on monarch butterflies would be possible if milkweed plants were removed during construction of the gen-tie, outside of the Dixie Meadows wetlands and riparian habitat. This could reduce availability of larval plants. However, preconstruction surveys by a qualified biologist, done in coordination with the BLM and partner agencies, would ensure that gen-tie pole placement and other activities avoid removal of milkweed plants (see EPMs in **Appendix J**, **Section J.1**). As a result, significant impacts on monarch butterfly habitat are not anticipated to occur.

Sensitive Aquatic Invertebrate and Wildlife Species (Dixie Valley pyrg, northern leopard frog, and Dixie Valley toad)

Direct impacts on the Dixie Valley toad in its terrestrial habitat could occur during construction of the power plant(s), well pads, and gen-tie in terrestrial habitat that is near breeding habitat in Dixie Meadows. This is because toads may use terrestrial habitat to forage. They may use rodent burrows for overwintering or thermal refuge during high temperatures.

Evidence (Halstead et al. 2021) indicates that toads use terrestrial habitat directly adjacent to breeding habitat in Dixie Meadows; therefore, surface grading could crush or bury toads using burrows in the construction area. Moreover, toads dispersing into or through terrestrial habitat in the construction area to reach overwintering or thermal refuge areas could be crushed by vehicles or machinery.

Implementing the EPMs in **Appendix J**, **Section J.2.2**, such as applying a surface disturbance buffer and installing suitable exclusion fencing around the perimeter of the work area near suitable breeding habitat in Dixie Meadows, would avoid this potential impact. Exclusion fence installation methods and timing would be coordinated with the BLM and partner agencies to ensure that fencing installation occurs when toads are least likely to be present in terrestrial vegetation in the construction area. Preconstruction surveys by a qualified biologist, also done in coordination with the BLM and partner agencies, would ensure that toads are not present in the construction area. Exclusion fencing would be maintained in functioning condition for the duration of construction, as determined by a qualified biological monitor, who would perform frequent inspections of the exclusion fencing while construction was ongoing. If toads were observed in the construction area during inspections, they would be relocated into suitable habitat outside exclusion fencing by the qualified biological monitor. Any relocations would be reported to the BLM and partner agencies within 24 hours (see **Appendix J**).

Springs and surface waters in Dixie Meadows support the Dixie Valley toad and reportedly support northern leopard frog, and they provide suitable habitat for the Dixie Valley pyrg, though as discussed in **Section 3.8.1**, Dixie Valley pyrg not been observed in Dixie Meadows. The project could directly and indirectly affect the Dixie Valley toad and its habitat and northern leopard frog and its habitat, and affect suitable habitat for the Dixie Valley pyrg. This would be the case if geothermal utilization, or consumptive groundwater extraction for construction water (if this occurred in the Dixie Valley Hydrographic Area) were to alter suitable aquatic habitat in Dixie Meadows by altering spring-discharged water quantity or quality (including temperature) or degrading surface water quality, as described in **Section 3.3.2**. If water quality (including temperature) or quantity were to be altered, this could reduce habitat suitability for these species. Reduced spring discharges during critical breeding or egg-laying times for the Dixie Valley toad, could result in substantial disruptions to life history cycles.

Implementing the extensive surface water, groundwater, geothermal, and biological monitoring measures described in Sections 3.1, 3.2, and 3.3 and Table 12 of the ARMMP (**Appendix H**) would avoid, minimize, and mitigate adverse impacts on the Dixie Valley toad and its habitat, northern leopard frog and its habitat, and suitable habitat for Dixie Valley pyrg from geothermal utilization, as needed; this includes through adaptive management and mitigation measures outlined in Section 3.9 of the ARMMP. Ongoing baseline studies similar to Halstead et al. 2021, published by the USGS and funded by the Navy, will add to the scientific understanding of the Dixie Valley toad. Specific benchmarks and thresholds associated with objectives for Dixie Valley toad and springsnail habitat outlined in the ARMMP would be adaptively modified in response to the best available science and agency-recommended best practices.

The high incidence of the *Bd* fungus among a nearby population of American bullfrogs in Dixie Valley may represent a serious threat to Dixie Valley toads (Forrest et al. 2013). Existing thermal conditions in the Dixie Hot Springs may be limiting or excluding the chytridiomycosis infection in Dixie Valley toads (Forrest and Schlaepfer 2011; Forrest et al. 2013). If geothermal utilization were to alter thermal conditions in Dixie Valley toad habitat by cooling the temperature, or reducing the volume of thermal discharges, thermal conditions may no longer limit or exclude the chytridiomycosis infection in Dixie Valley toads. This is because the fungus grows best in cooler conditions (Berger et al. 2004; Chatfield and Richards-Zawacki 2011). Because Dixie Meadows represents the entire known distribution for the Dixie Valley toad, chytridiomycosis infection in this population could result in extirpation. Implementing the surface water temperature monitoring and mitigation measures described in Section 3.9.1 in the ARMMP (**Appendix H**) and Sections J.2.2 and J.2.3 in **Appendix J** would prevent or mitigate alterations in thermal conditions in Dixie Valley toad habitat.

Indirect, temporary impacts are not anticipated for the Dixie Valley toad or its habitat, northern leopard frog or its habitat, or suitable habitat for Dixie Valley pyrg from changes in surface water quality resulting from construction activities. Examples of these impacts are erosion and runoff and sedimentation from surface disturbance in the project area. These impacts are not anticipated because no surface occupancy lease stipulations would prevent surface-disturbing activities within 500 to 650 feet of riparian areas (see full lease stipulations in **Appendix A**). Stipulations would protect the integrity of these resources, which are delineated by the presence of riparian vegetation and not actual water. Further, ephemeral washes and drainages outside of no surface occupancy areas would be avoided during construction, to the extent possible. Moreover, erosion control EPMs (**Appendix J**) would minimize impacts where proposed roads must cross ephemeral drainages.

EPMs also include minimizing soil disturbance, intercepting stormwater in ditches and energy dissipaters, maintaining access roads consistent with BMPs, and following BLM BMPs for stormwater on public lands. Such measures would minimize the potential that ephemeral washes and drainages would convey sediment-laden runoff to wetlands, ponds, or other downstream habitat.

Implementing the environmental compliance and protection measures described in **Section J.1.2** of **Appendix J** and Section 4 of ORNI 32's Utilization Plan (Ormat 2021) would avoid contamination of surface water or groundwater from spills of petroleum products (such as diesel fuel or lubricants). Constructing berms around the well pads and power plant sites, where most petroleum products would be used and stored, would contain and control any accidental spills. As described in **Section 3.17**, Public Health and Safety and Hazardous Materials, any spill of hazardous waste or hydrocarbons would be remediated by following all local, state, and federal regulations.

ORNI 32 would comply with the EPMs in **Appendix J**, including the spill or discharge contingency plan (**Section J.4.1** of **Appendix J**). Accidental discharges of geothermal fluids are unlikely because of frequent inspections, ultrasonic testing of the pipeline, flow and pressure monitoring, and well pump and pipeline valve shutdown features, as outlined in **Appendix J**. These construction best practices and EPMs would reduce the potential for spill-related impacts on water quality and the associated aquatic habitat by containing spills and ensuring cleanup would occur in a more expedited manner should a spill occur.

Overhead transmission lines can provide nesting habitat and perches for raptors and can thus increase predation pressure. Corvid abundance increases around transmission lines (Prather and Messmer 2010). Ravens, which nest in Dixie Valley, are known predators of western toads (Olson 1989). It is reasonable to assume they may prey on Dixie Valley toads as well. Installing the northern gen-tie may thus increase predation pressure on Dixie Valley toads. Implementing the aquatic resources monitoring and mitigation in the ARMMP **Appendix J**, such as installing anti-perch devices and siting transmission towers, stringing sites, and other temporary work areas outside of Dixie Valley toad habitat, would avoid avian predation on Dixie Valley toads. Further, implementing twice annual monitoring of Dixie Valley toad distribution and abundance and identifying potential changes, impacts, thresholds, and triggers as described in the ARMMP (**Appendix H**) would facilitate the detection and response to any population changes.

Sensitive aquatic wildlife species-specific mitigation measures are included in **Appendix J** (see **Section J.2.2**). In summary, these are implementing the ARMMP, preventing spread of *Bd*, applying surface disturbance avoidance buffers around surface water resources, siting construction areas outside of surface water resources, and using exclusion fencing to prevent wildlife entry to sumps and other work areas.

Birds

Greater sage-grouse

Implementation of the Proposed Action would result in approximately 104 acres of disturbance of greater sage-grouse OHMA (BLM GIS 2016); of the 104 acres, 103 acres would be reclaimed following construction. Appendix C of the Greater Sage-Grouse ROD (BLM 2015a) includes RDFs that are required for certain activities in all greater sage-grouse habitat, including areas mapped as OHMA. The RDFs are included as **Appendix B** of this EA. RDFs establish specifications to help mitigate adverse impacts on the species. RDFs would not apply in greater sage-grouse non-habitat areas.

In addition to the RDFs, the 2015 Decision requires compliance with lek buffers (BLM 2015a, Appendix B), Fluid Mineral Stipulations (BLM 2015a, Appendix G), and Noise Protocol (BLM 2015a, Appendix M), as well as applicable Special Status Species, Leased Fluid Minerals, and Land Use Authorizations Management Decisions outlined in Section 2.2 of the 2015 Decision.

ORNI 32 would comply with the applicable RDFs in greater sage-grouse OHMA and lek buffers, as well as fluid mineral stipulations, noise protocols, and applicable management decisions in the 2015 Decision, as outlined in **Section 1.4**, Land Use Plan Conformance. Sagebrush habitat would be avoided, to the extent possible, by using existing roads or other areas devoid of sagebrush (WO-IM-2012-043). Additionally, all power poles would use BLM-approved raptor deterrents in greater sage-grouse habitat, in accordance with the RDFs. With adherence to the protection measures, in addition to conformance with the greater sage-grouse 2015 Decision, potential impacts on greater sage-grouse would be further reduced.

The BLM and ORNI 32 would continue to consult with the SETT to offset temporary and permanent impacts on greater sage-grouse habitat, commensurate with habitat function, as determined by the field-verified HQT assessment. Implementation actions would be determined in coordination with the BLM. The credit system would ensure that greater sage-grouse habitat impacts are offset by long-term enhancement and protection of habitat.

Golden eagle

Implementation of the Proposed Action would result in a net loss of golden eagle foraging habitat for the life of the project. While the project site does not support golden eagle nesting habitat, it is expected that golden eagles could forage within the project area throughout the year. Due to the size of the project compared with available foraging habitat, population-level effects on golden eagles in the region are unlikely from loss of foraging habitat.

The nearest active nest to the lease areas and northern gen-tie route is located approximately 5,700 feet (1.1 miles) northwest of the geothermal lease boundary; this nest is located approximately 7,400 feet (1.4 miles) away from the northern gen-tie. The nearest inactive nest is approximately 6,050 feet (1.2 miles) from the geothermal lease boundary and approximately 8,300 feet (1.6 miles) from the northern gen-tie (Ormat GIS 2016).

In the absence of avoidance and minimization measures, operation of the gen-tie could result in direct mortality to golden eagle from striking the gen-tie or electrocution, similar to impacts as discussed under **Section 3.5**, Migratory Birds. Indirect, temporary effects from noise, human presence, and heavy equipment present during construction activities may lead to disturbance or displacement. This may lead to nesting failure or abandonment, constituting take under the BGEPA.

To minimize and avoid impacts, design features (APLIC 2006, 2012) and construction timing restrictions would be implemented. These measures are described in detail in Section 5.1 of the BBCS (**Appendix C**). As a result, neither construction nor operation of the project is expected to result in take or disturbance of golden eagles as defined under the BGEPA.

Burrowing owl and western snowy plover

Three active burrowing owl burrows were observed within half a mile of the northern gen-tie alignment in 2011; inactive burrowing owl burrows were observed in 2016, along the northern gen-tie alignment. Western snowy plover has the potential to occur on playa habitat traversed by the northern gen-tie alignment.

Construction could impact burrowing owl or western snowy plover by reducing available nesting or foraging habitat. It could also cause individuals to avoid foraging in otherwise suitable habitat. This would be due to increased human or equipment presence or noise. These factors could cause owls to abandon their burrows or plovers to abandon nests. Increased scavenger or raptor perching opportunities may also increase the risk of predation on these species and their young.

Impacts would be avoided or minimized by adhering to the measures outlined in Sections 5.1 and 5.2 of the BBCS (**Appendix C**), including conducting preconstruction surveys. If any active nests are found in proximity to work areas, a buffer zone determined by the BLM would be established around the nest and work would be avoided in this area until after the young have fledged.

EPMs under the Proposed Action would further reduce impacts. These include reclaiming temporarily disturbed areas, to promote the reestablishment of native plant and wildlife habitat, and using BLM-approved raptor perch deterrents on power poles.

Loggerhead shrike, sage thrasher, and Brewer's sparrow

Impacts on sensitive loggerhead shrike, sage thrasher, and Brewer's sparrow from the Proposed Action would be the same as those described in **Section 3.5**, Migratory Birds. Impacts would be avoided or minimized by adhering to the mitigation measures outlined in Sections 5.1 and 5.2 of the BBCS (**Appendix C**), including conducting preconstruction surveys. If any active nests are found in proximity to work areas, a buffer zone determined by the BLM would be established around the nest and work would be avoided in this area until after the young have fledged.

Sensitive raptor species

Impacts on sensitive raptor species, including ferruginous hawk, Swainson's hawk, peregrine falcon, and bald eagle, from the Proposed Action would be the same as those described in **Section 3.5**, Migratory Birds. Impacts would be avoided or minimized by adhering to the mitigation measures outlined in Sections 5.1 and 5.2 of the BBCS (**Appendix C**). These include conducting preconstruction surveys and implementing APLIC (2006, 2012) guidelines. If any active nests are found in proximity to work areas, a buffer zone determined by the BLM would be established around the nest and work would be avoided in this area until after the young have fledged.

Mammals

Bats

A BBCS (**Appendix C**) was developed. Its purposes, in part, are to reduce the potential of injury or mortality to bats from project construction and operation, to ensure adequate monitoring is in place to determine if mortalities are occurring, and to provide a mechanism to implement adaptive management as needed to reduce injury or mortality.

Ponds, tanks, and impoundments (including but not limited to drill reserve pits) containing liquids can present hazards to bats (BLM 2008b). Bat access to any liquids contaminated by substances that may be harmful due to toxicity, fouling of the coat (detergents and oils), or excessive temperatures would be excluded by wildlife-proof netting or other covering at all times when not in active use. This measure would conform to Appendix D, Best Management Practices – Mitigation Measures, of the BLM's 2008 geothermal leasing PEIS (see **Appendix F** of this EA). Netting specifications are given in the additional mitigation measures in **Appendix J**.

Direct impacts on the abandoned mine workings near the Jersey Valley Geothermal Power Plant are not anticipated, as these sites are avoided, no activities are proposed at these sites, and no drilling through underground workings is proposed. However, these sites have a high hazard rating due to human activity and the extent of workings. To reduce the potential for any impacts on either bats, which use the workings, or to human safety, no mines would be entered.

Construction noise and activities could impact roosting bats adjacent to the project area. Because abandoned mine workings near the Jersey Valley Geothermal Power Plant function as hibernation and maternity locations, disturbance to roosting bats could be especially damaging to local populations if impacts were to occur during critical hibernation and maternity periods. However, construction activities in this area would be of temporary duration, and would be limited to installing several power poles and connecting the northern gen-tie to the existing substation. Further, any bats using the area are likely already acclimatized to some degree to the existing power plant at this location. As a result, any additional effects of potential disturbance from the gen-tie installation on roosting bats are expected to be minor.

The quieter and more consistent background noise associated with the operation of the proposed power plant(s) could affect bat foraging ability. Bats may be affected by the power plants' operational noise. This is because they echolocate and receive sound waves in a wide range of frequencies, including those both audible and inaudible to humans. Additionally, operational noise may disrupt bat foraging behavior by acoustic masking, attentional distraction, and eliciting an avoidance response.

In effect, noise may create a larger area of habitat disturbance than the project footprint alone. Operation noise would be minimized through the EPMs in **Appendix J** and described in **Section 2.1.3**, such as designing the plants to take advantage of noise-reducing design, including from cooling fans. Vinyl fencing slats surrounding the plants would also reduce operational noise in adjacent habitat. BLM regulations mandate that noise at one-half mile—or at the lease boundary if closer—from a major geothermal operation shall not exceed 65 A-weighted decibels (43 CFR 3200.4(b)).

Foraging habitat for bats is available throughout the project area, particularly meadow areas near the geothermal lease areas. Bats may use or depend on the relatively high abundance of aquatic insects and resulting important foraging opportunities provided in these areas. Negative impacts could occur if bats were prevented from foraging in these areas during project construction or operation. Impacts on foraging habitat would affect only individual bats and would not impact the local or regional bat population. This is because bats would likely forage in adjacent undisturbed habitats. Implementing the BBCS (**Appendix C**) would further reduce the potential for impacts.

Additionally, adverse impacts on the springs and seeps in the project vicinity are unlikely, given avoidance and minimization measures in **Section 3.3**, Water Resources, and **Section 3.9**, Wetlands and Riparian Vegetation; therefore, indirect impacts on the associated foraging habitat are anticipated to be minor.

Lights used for drilling at night and power plant operations may attract and concentrate moths and other insects on which bats may feed; this could be a beneficial effect, though this could also alter bat behavior. Implementing motion-activated lighting, directed lighting, shielding methods, reduced lumen intensity lighting, and other dark sky-compliant lighting techniques (see **Appendix J** and Ormat 2021) would avoid or reduce the potential for impacts on bats from project lighting.

Pygmy rabbit

The project area has marginal habitat for pygmy rabbits, and no pygmy rabbits or their sign were observed during the biological surveys. However, pygmy rabbits have been observed in the project vicinity and could be impacted by the project. Pygmy rabbits could be injured or killed by project construction or vehicle traffic or have burrows crushed by equipment. Preconstruction surveys would be required in all suitable habitat, and burrows would be avoided (see **Appendix J, Section J.2.1**). Any impacts on the species or habitat would not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species.

Kangaroo mice

Surface disturbance associated with construction could result in the loss of kangaroo mouse habitat. Given the limited surface disturbance, habitat impacts would be minimal and concentrated around the power plant(s), well pads, and gen-tie construction areas. Similar habitat that would not be impacted is abundant in the project vicinity.

Additional construction crew traffic would increase the probability of running over a kangaroo mouse, especially if vehicles are used at night; however, vehicle speeds would be limited to 25 miles per hour through the area, and nighttime construction and operation traffic is not proposed. Dixie Valley Road is open to public use, and likely sees some nighttime use; therefore, any additional construction-related traffic would have only incremental impacts over existing conditions.

Artificial night lighting sources used primarily during drilling and construction and, to a lesser extent, during project operations, could impact kangaroo mice if they were present in the lit area. Using artificial night lighting may cause nocturnal rodents (such as kangaroo mice) to decrease activity (Kramer and Birney 2001; Clarke 1983) and alter foraging behavior (Vasquez 1994). Also, using artificial night lighting can increase owl hunting effectiveness on nocturnal rodents (Clarke 1983). To reduce impacts on kangaroo mice from project lighting, motion activated lighting, directed lighting, shielding methods, and reduced lumen intensity lighting would be used.

Preconstruction surveys for sensitive wildlife species would be conducted. If kangaroo mice were observed during such surveys, measures to avoid or minimize impacts would be developed, in coordination with BLM or NDOW or both.

With incorporation of the measures above, potential impacts may affect any kangaroo mice in the project area; however, impacts would not cause a loss of viability to the population or species.

Bighorn sheep
Impacts on bighorn sheep may occur from noise or human presence during construction. Bighorn sheep may avoid foraging in or crossing through the project area during construction; however, this impact would be temporary, and the surrounding area has suitable foraging habitat.

Alternative 1 (Southern Gen-tie Route)
The nature and type of impacts on sensitive species and their habitat under Alternative 1 would be similar to those described under the Proposed Action, with the exceptions described below. The EPMs in **Appendix J**, **Section J.1**; implementation of other plans described in that section; implementation of the BBCS (**Appendix C**) and ARMMP (**Appendix H**); and their associated impacts under Alternative 1 are the same as those described under the Proposed Action. Regardless of the gen-tie routing option chosen under Alternative 1, impacts from either routing option would be the same.

According to the 2015 Decision, there is no mapped greater sage-grouse habitat within the southern gen-tie route; therefore, implementation of Alternative 1 would have no impacts on greater sage-grouse or its habitat under the 2015 Decision. Compliance with the Greater Sage-Grouse ROD (BLM 2015a) would not apply under Alternative 1. ORNI 32 would offset temporary and permanent impacts on greater sage-grouse habitat, commensurate with habitat function, as determined by a HQT assessment in coordination with the SETT. Implementation actions would be determined in coordination with the BLM.

The nearest active golden eagle nest to the southern gen-tie route is approximately 4,940 feet. Since the nearest active nest to the southern gen-tie alignment is approximately 2,460 feet closer than the nearest active nest to the northern gen-tie alignment, the potential for impacts from disturbance during the nesting season, and collision or electrocution would be somewhat increased under Alternative 1. However, EPMs under Alternative 1 are the same as those described under the Proposed Action, including implementation of the BBCS (**Appendix C**), and these would reduce impacts to a similar degree as under the Proposed Action.

Potential impacts on pale kangaroo mouse may be more likely under Alternative 1. This is because suitable habitat for this species is more prevalent in the southern portion of the southern gen-tie alignment. The pale kangaroo mouse occurs in habitats with sandy, wind-blown soils or active or stabilized dunes, and these habitats are present in the southern gen-tie route. In order to avoid or minimize impacts on these species, preconstruction surveys would be conducted within suitable habitats in early spring to determine presence or absence of these species. If present, specific avoidance and/or minimization measures would be determined in consultation with the BLM or NDOW or both.

Several sensitive plant species also have potential to occur in sandy soils along the southern gen-tie route; however, they were not detected during focused botanical surveys in 2013 (ESRS 2013). Therefore, no additional impacts on sensitive plants are expected from implementation of Alternative 1.

Sensitive species-specific mitigation measures (**Appendix J**, **Section J.2.2**) would be the same as described under the Proposed Action.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the Proposed Action, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. As such, there would be no change in existing sensitive species conditions at the site.

3.9 Wetlands and Riparian Areas

3.9.1 Affected Environment

NAS Fallon delineation

In 2007, NAS Fallon conducted a wetland delineation in Dixie Meadows, on the Navy land known as the Lamb Mineral interests (and on which ORNI 32 owns the underlying mineral rights). This area generally encompasses the Dixie Hot Springs complex. Wetland areas mapped during the study are comprised of the following habitat categories: marshes, moist mixed grasslands (moist-saline meadows and flats), and woodlands; descriptions of these features are summarized below (NAS Fallon 2008).

Marshes are seasonally to semi-permanently flooded habitats dominated by grass-like plants; the most common are Baltic rush (*Juncus balticus*), bulrushes (*Scirpus* spp.), spikerushes (*Eleocharis* spp.), cattails (*Typha* spp.), and sedges (*Carex* spp.). Grasses, such as saltgrass (*Distichlis spicata*), are also present. Vegetation species in marshes are typical of Great Basin marsh habitats.

In the Cowardin system (Cowardin et al. 1979), marshes are classified as palustrine emergent wetlands that are at least seasonally flooded. Small shallow ponds surrounded by marsh vegetation are also included in this category. While vegetation is predominantly herbaceous, willows (*Salix* spp.), cottonwoods (*Populus fremontii*), or other woody species like tamarisk and Russian olive may be present as scattered individuals. The Dixie Hot Springs complex likely supplies a perennial water source for marsh wetlands in the project area.

Moist mixed grasslands are areas that are temporarily to intermittently flooded and typically support low-growing grasses that tolerate saline and seasonally saturated soils. Such habitats are commonly transitional between uplands and wetter areas such as marshes. Saltgrass meadows on playas also fall into this group. Typical vegetation is inland saltgrass (*Distichlis spicata* var. *stricta*) as a dominant or subdominant species.

Grasslands in Dixie Meadows range from nearly complete saltgrass cover, to areas co-dominated by other native grasses like creeping wildrye (*Elymus triticoides*) and Nevada bluegrass (*Poa secunda* ssp. *juncifolia*), with saltgrass at a much lower cover. These areas likely represent pockets of lower salinity soils (NAS Fallon 2008). Other species present are common sunflower (*Helianthus annuus*), sharp-pointed bulrush (*Scirpus pungens*), western niterwort (*Nitrophila occidentalis*), and iodinebush (*Allenrolfea occidentalis*). Under the Cowardin system, most moist mixed grasslands are classified as palustrine emergent wetlands that are unpredictably flooded for brief periods.

Woodlands are habitats with significant shrub or tree cover that range from temporarily to permanently flooded. Overstory vegetation is typical of Nevada's riparian areas; willows, Fremont cottonwood, tamarisk, Russian olive, and wild rose (*Rosa woodsia*) may be present. These areas are classified as palustrine scrub-shrub or forested wetlands, often with an emergent wetland understory.

2019 Aquatic Resources Monitoring and Mitigation Plan Delineation

ORNI 32 conducted an inventory of spring-dependent ecosystems and aquatic habitat during preparation of the ARMMP. The results of the inventory were used to establish baseline monitoring and control sites (the ARMMP is summarized in **Appendix J** and included in its entirety in **Appendix H**).

Eight distinct wetland communities were identified and quantified in more detail in the ARMMP. Communities were characterized by the dominance of one to several plant species. The wet meadow and field sedge meadow wetland types were generally closely coupled, often occurring as large mosaics of meadow habitat. These meadow areas graded gently between both wetland types, resulting from the microtopography of the landscape and changes in soil saturation. The wetland areas were generally grouped into six spring complexes, as shown in Figures 6 to 12 of the ARMMP. The ARMMP also includes summaries of data gathered during the delineation in Tables 2 to 4. Wetland communities are summarized below.

Wetland boundary

The wetland boundary is a species-rich community occurring at the interface between upland and wetland communities; it shares many species in common with both. The community is dominated by inland saltgrass, annual rabbitsfoot grass (*Polypogon monspeliensis*), and chairmakers bulrush (*Schoenoplectus americanus*). The community is also characterized by the presence of wetland obligates, such as spikerushes (*Eleocharis* spp.), and facultative wetland species, such as clustered field sedge (*Carex praegracilis*) and Baltic rush (*Juncus balticus*). A total of 8.1 acres of wetland boundary occurs in the project area.

Bulrush wetland

The interior of most spring complexes is dominated by nearly impenetrable stands of bulrush (*Schoenoplectus* spp.). This community prevails in areas with saturated soils or standing water. It is dominated by chairmakers bulrush. Hardstem bulrush (*Schoenoplectus acutus*) is dominant in small patches, distributed widely throughout this community type. Indian hemp (*Apocynum cannabinum*) occurs in thick stands, intermixed with *Schoenoplectus* spp., at the boundary between this community and the wetland boundary community. A total of 116.7 acres of bulrush wetland occurs in the project area.

Cattail wetland

This wetland community is characterized by nearly monotypic stands of southern cattail (*Typha domingensis*). A total of 1.8 acres of cattail wetland occurs in the project area.

Common reed wetland

This community is characterized by nearly monotypic stands of reed canarygrass (*Phalaris arundinacea*) that occurs in widely distributed patches. A total of 9.1 acres of reed canarygrass wetland occurs in the project area.

Saltgrass and alkali bulrush wetland

This is a sparsely vegetated community dominated by inland saltgrass. Of note was the presence of many patches of alkali bulrush (*Scirpus maritimus*) in this community type occurring in the highly alkaline soils on the fringes of the Humboldt Salt Marsh. A total of 12.5 acres of saltgrass and alkali bulrush wetland occurs in the project area.

Wet meadow

Wet meadow occurs on the fringes of bulrush wetlands, and in other areas of standing or flowing water. This community was dominated by Baltic rush, common spikerush (*Eleocharis palustris*), and clustered field sedge (*Carex praegracilis*). A total of 3.7 acres of wet meadow occurs in the project area.

Field sedge meadow

This community type can be characterized as a drier version of the wet meadow, where clustered field sedge (*Carex praegracilis*) dominates and obligate wetland species, such as common spikerush, rarely occur. This community type is commonly the boundary between wetlands and non-wetlands; it is defined by either a distinct boundary or subtle gradients into meadows dominated by facultative-upland species (e.g., *Poa secunda*). Of note was the extensive cover of common sunflower (*Helianthus annuus*) seedlings within the drier parts of this community type. A total of 37.4 acres of field sedge meadow occurs in the project area.

Meadow
In various parts of the project area, a heterogeneous mixture of wet meadow and field sedge meadow community types occur. These communities generally have indistinct boundaries (unlike the distinct boundaries between the above meadow communities), differentiated due to microtopographic features. A total of 46.5 acres of meadow habitat occurs in the project area.

Woody riparian.
This community type consists of woody species, generally rooted in areas adjacent to flowing water. Though this community is dominated by chairmakers bulrush and common sunflower, the presence of various exotic woody species, such as saltcedar (*Tamarix* spp.) and Russian olive (*Eleaeagnus angustifolia*), and native species, such as willow (*Salix* spp.), resulted in a unique and structurally rich community type. A total of 2.8 acres of woody riparian habitat occurs in the project area.

Disturbance factors
In 2014, a road was installed through a portion of the main Dixie Meadows hot spring wetlands to gain access to the existing 230 kV power transmission line connected to the Dixie Valley (Terra-Gen) Power Plant. The road bisected approximately half of the Dixie Meadows wetland area and resulted in the alteration of surface flow patterns that support surrounding and downstream wetlands, riparian areas, and associated aquatic habitat. The road was removed, and restoration is currently ongoing. A wetlands mitigation and monitoring plan was put in place to observe the hydrologic characteristics (temperature, wetted area, or vegetation) and to intervene if a negative change in habitat quality or quantity should occur. The road is still affecting surface flow patterns through a portion of the wetland area (Terra-Gen Dixie Valley 2015a; 2015b). The road is clearly visible in base aerial images used for the ARMMP figures (**Appendix H**).

3.9.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)
Surface disturbance from gen-tie construction would not occur in any wetlands or riparian areas; therefore, direct effects from vegetation damage or removal, and from soil compaction or disturbance would not occur. The proposed gen-tie route follows the county road in Dixie Meadows and does not cross the series of springs and associated wetlands and riparian vegetation in T22N, R35E, Sections 4, 5, and 8 in the northern portion of Dixie Meadows. There is the potential that surface disturbance during construction in upland areas could

increase erosion and sedimentation to nearby springs and decrease groundwater infiltration and recharge rates in these areas. This could reduce wetland vegetation coverage in affected areas.

Potential impacts associated with surface disturbance would be avoided by implementing minimization and mitigation measures proposed for water resources (see **Section 3.3.2**). Following the wetlands and riparian area stipulations for the various leases (**Appendix A**) would avoid impacts on surface water resources from construction and operations. Preventing grading or vegetation clearing on hydric soils, as identified in the wetland delineation (see **Section J.2.2** in **Appendix J**), would further avoid impacts on wetlands and riparian areas.

As described in **Section 3.3.2**, geothermal utilization, including production and injection, well testing, and temporary consumptive groundwater withdrawals for construction water, could reduce the volume or temperature, or alter water chemistry, of water at groundwater discharge points such as springs and seeps. A study by Morrisson et al. (2013) showed that spring-fed aquatic environments may be altered substantially by relatively small decreases in spring flows. The effect of any reduction in surface water flows on wetlands and riparian habitat would manifest as an alteration of species composition or reduced wetland plant cover. The volume of fluid withdrawn during the approximately 2–4 weeks of well testing would be negligible compared with the volume of fluid naturally available in the aquifers. Therefore, there is no evidence to suggest the removal of geothermal fluids during testing would alter spring flows and the associated wetland conditions.

Further, significant adverse impacts on wetland or riparian habitat would be avoided, minimized, or mitigated by implementing applicable adaptive management actions and mitigation measures (see **Section J.2.3** in **Appendix J**) in response to monitoring data compiled per the ARMMP (**Appendix H**). Site-specific monitoring of springs and seeps supporting wetlands and riparian areas would occur during well testing, including pumping tests, flow tests, injection tests, and tracer tests, to aid in detection of potential changes or impacts on water quantity or temperature, which could indirectly impact wetland and riparian vegetation (see Section 3 of the ARMMP in **Appendix H**).

ORNI 32 would also monitor wetland and riparian vegetation during the course of construction and operations to ensure adverse impacts do not occur. Monitoring would include percent cover and species composition using photo points (qualitative) and line-point (quantitative) monitoring methods, as well as using aerial imagery to detect potential changes in vegetation (see Section 3 of the ARMMP in **Appendix H**). If any potential impacts are detected, implementing the mitigation measures in Section 3.9 of the ARMMP (**Appendix H**) would minimize or reverse these impacts. Mitigation measures could include habitat manipulation and improvement projects, noxious and nonnative weed treatments (see Section 3.9 of the ARMMP in **Appendix H**), and adaptive management techniques per **Section J.2.3** in **Appendix J**. These monitoring and mitigation measures would avoid, minimize, or mitigate impacts on wetland and riparian habitat.

Adaptive management measures that could be implemented, if needed, in response to monitoring data would maintain preconstruction shallow groundwater levels, riparian conditions, and spring temperatures (see **Section J.2.3** in **Appendix J**). Adaptive management could also include the temporary cessation of pumping and injection until monitoring data indicate a return to preconstruction conditions. Ongoing riparian habitat monitoring would also inform additional future management to maintain pre-operation riparian area conditions.

As noted in the EPMs in **Appendix J**, geothermal fluids would not be discharged to the ground under normal operating conditions, and accidental discharges would be unlikely because of the use of practices such as providing reserve pits, frequent inspections, pipeline testing, flow and pressure monitoring, and automatic well and valve shutdown features. If geothermal fluids or other chemicals were accidentally released or discharged, wetland or riparian habitat could be affected by plant mortality or reduced physiological function. The extent of the impact would depend on the type and amount of fluid accidentally released or discharged and the relative distance of the contaminated area to groundwater or surface water and riparian vegetation. To avoid such impacts, ORNI 32 would comply with the EPMs in **Appendix J**, including the spill or discharge contingency plan.

Indirect effects on wetland and riparian habitat could also include the potential for increased weed establishment and spread from soil disturbance during construction. Weed spread may alter habitat conditions, resulting in changes to hydrology and vegetation composition. The Proposed Action and EPMs outlined in **Appendix J**, such as minimizing cut and fill activities, using existing access roads where possible, limiting the footprint of well pads to only the size necessary for drilling and operations, preparing a weed management plan, and revegetating disturbed areas using a BLM-approved weed-free seed mix, would reduce the potential for weed establishment and spread. As a result, the Proposed Action would have no net increase in the amount of weeds on-site during the life of the project.

Indirect impacts could also result from fugitive dust generated during construction that settles on wetland vegetation, reducing productivity. Several proposed well pads are within 1,000 feet of wetlands. The proposed power plants are approximately 2,000 feet from the nearest wetland. Implementing the EPMs in **Appendix J**, such as applying water to the ground during the construction and utilization of the drill pads, access roads, and other disturbed areas, and implementing other dust control measures in accordance with the project's approved dust control permit would avoid dust-related impacts on wetland areas.

Direct permanent and temporary impacts on playa habitat are not expected; however, if impacts do occur, they would be minimized by implementing the EPMs outlined in **Appendix J**. Additional potential indirect impacts on wetlands and playa habitat, including establishment and spread of weeds and the deposition of fugitive dust, would be minimized or avoided by implementing the EPMs outlined in **Appendix J**.

In summary, implementing surface occupancy restrictions in the lease stipulations (**Appendix A**), EPMs (**Appendix J**), and the ARMMP would avoid, minimize, and mitigate direct and indirect significant adverse impacts on wetland or riparian habitat.

Alternative 1 (Southern Gen-tie Route)

The nature and type of impacts on riparian resources and habitats under Alternative 1 would be similar to those described under the Proposed Action.

Under Alternative 1, the gen-tie would require 18 acres of permanent disturbance compared with the 12 acres of permanent disturbance under the Proposed Action. The southern gen-tie ROW crosses several ephemeral drainages that may flow into or near the cold springs and associated wetlands. These are in the southern portion of the Dixie Meadows area in T22N, R35E, Sections 18 and 19, between 1,700 and 2,100 feet from the southern gen-tie alignment. The springs supporting these wetlands are believed to be fed by groundwater, as opposed to surface recharge from ephemeral drainages. Because of this, any loss of ephemeral drainages are not likely to impact the spring flow to the wetlands; however, erosion from ROW construction could increase sedimentation to wetlands, indirectly affecting wetland vegetation.

To avoid or minimize erosion and sedimentation impacts, the construction site would be accessed via existing routes, to the extent possible. Where access is necessary and no reasonable access roads exist, ORNI 32 would use overland travel to access the ROW. Surface grading or vegetation clearing for gen-tie construction would occur only when necessary for safe access or for installing the conductors, and only in the proposed ROW. Any surface disturbance would comply with BLM BMPs.

Surface occupancy restrictions in lease stipulations, EPMs, and implementation of the ARMMP and their associated impacts under Alternative 1 are the same as those described under the Proposed Action. Wetlands and riparian area-specific mitigation measures (**Appendix J**, **Section J.2.2**) would be the same as described under the Proposed Action.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the Proposed Action, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. As such, there would be no change in existing wetland or riparian conditions at the site.

3.10 Invasive, Nonnative, and Noxious Weed Species

The Federal Noxious Weed Act of 1974 provides for the control and management of nonindigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health. The act prohibits importing or moving any noxious weeds identified by the regulation and allows for inspection and quarantine to prevent the spread of noxious weeds.

Signed in 1999, Executive Order 13112 directs federal agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause. To do this, the executive order established the National Invasive Species Council; currently there are 13 departments and agencies on the council.

The Noxious Weed Control and Eradication Act (Public Law 108-412) of 2004 requires the Secretary of Agriculture to establish a program to assist eligible weed management entities to control or eradicate noxious weeds on public and private land.

3.10.1 Affected Environment

The state of Nevada lists 47 noxious weed species that require control (Nevada Administrative Code 555.10). Of these, five have been observed in the project area during biological surveys: tamarisk (*Tamarix ramosissima*), tall whitetop (*Lepidium latifolium*), Russian knapweed (*Acroptilon repens*), hoary cress (*Cardaria draba*), and Russian olive (*Elaeagnus angustifolia*; EMPSi 2016; ESRS 2013).

Tamarisk was observed in several locations within the greasewood flat vegetation community, along the proposed northern gen-tie and in the vicinity of the proposed power plant locations. Several patches of tall whitetop were observed along the both gen-tie alignments. Two Russian olive trees and a few hoary cress individuals were observed in the Dixie Springs area. Russian knapweed was observed along the northern gen-tie alignment through the Jersey Valley, where several thousands of plants exist in several discrete and dense patches within annual grassland. A small disused reservoir or holding pond in the vicinity of the Jersey Valley Hot Springs, near the northern terminus of the northern gen-tie, contains a dense infestation of Russian knapweed, tall whitetop, and hoary cress.

Additional invasive, nonnative plant species observed in the project area include cheatgrass (*Bromus tectorum*), halogeton (*Halogeton glomeratus*), bur buttercup (*Ceratocephala testiculata*), and clasping pepperweed (*Lepidium perfoliatum*).

3.10.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)

The Proposed Action has the potential to increase the spread of noxious weeds and invasive, nonnative plants. Weed 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 could also be introduced by construction equipment brought to the project from infested areas or by using seed mixtures or mulching materials containing weed seeds.

The potential for the Proposed Action to increase the spread of noxious weeds and invasive, nonnative plants would be minimized by EPMs as described in **Appendix J**, including preparation of an invasive plant management plan prior to construction, minimizing surface disturbance during construction, and using a BLM-approved, weed-free seed mix during restoration of temporarily disturbed areas.

Alternative 1 (Southern Gen-tie Route)

The nature and type of impacts under Alternative 1 would be similar to those described under the Proposed Action. However, Alternative 1 would result in 6 more acres of soil disturbance, which would slightly increase the potential for noxious weed and invasive, nonnative plant establishment and spread.

Regardless of the gen-tie routing option chosen under Alternative 1, impacts on noxious weeds and invasive, nonnative plants from either routing option would be the same.

EPMs and their associated impacts under Alternative 1 are the same as those described under the Proposed Action.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the Proposed Action, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. As such, existing trends for noxious weeds and invasive, nonnative plants would continue.

3.11 VISUAL RESOURCES

3.11.1 Affected Environment

Section 102(a)(8) of the FLPMA establishes the policy that public lands be managed in a manner that would protect the quality of scenic values (43 USC 1701(a)(8)). To meet this responsibility, the BLM uses the visual resource management (VRM) system (BLM Manual 8400, Manual H-8410-1, and Manual H-8431).

The BLM initiated the VRM process to manage the quality of landscapes on public lands and to evaluate the potential impacts on visual resources resulting from development activities. The VRM system addresses different levels of scenic values, which require different levels of management. The BLM uses four unique VRM classes to assess scenic values and visual impacts. VRM Class I is the most restrictive toward landscape alteration and development activities, and VRM Class IV is the least restrictive (BLM 2007c).

VRM classes are utilized to identify minimum levels of degradation of the visual resource when a proposed development action is analyzed using the BLM's Visual Resource Management Inventory and Contrast Rating Manuals 8410-1 and 5432-1.1. By using this system, the impact magnitude on visual resources can be measured by separating the landscape into its major features (landform, vegetation and structures) and predicting the magnitude of change to each of the basic visual elements (line, form, color and texture) within each of the features (BLM 2012a).

The proposed project would occur in an area where no VRM classes have been established (BLM GIS 2016). When no VRM classes exist, the CRMP standard operating procedures state that an interim VRM objective is to be assigned at the time a project is proposed. The VRM objectives are to be developed using the guidelines established in BLM Manual H-8410-1 and must conform to land use allocations set forth in the CRMP.

In 2012, the BLM published a visual resources inventory (BLM 2012b). The report recommended the project area and surrounding lands as interim VRM Class III objective to allow for management decisions consistent with the resource allocations for the area. The VRM Class III objective is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the casual observer's view. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape (BLM 2012a). Since the primary resource uses within the project area are grazing and energy development, establishing an interim VRM Class III objective would be in compliance with current guidelines and policy for VRM.

The characteristic landscape of the project area is dry and arid desert, with the Stillwater Mountain Range and central Nevada desert surrounding the proposed project site and gen-tie.

Sensitive visual receptors in the project area include people recreating in the area and sacred sites used for spiritual use. Recreational activities can include hiking, bird-watching, nature photography, mountain biking, and OHV use. Spiritual use is described in **Section 3.13**.

Visual Contrast Rating

The degree to which a project adversely affects the visual quality of a landscape relates directly to the amount of visual contrast between it and the existing landscape character. The degree of contrast is measured by separating the landscape into major features (land, water, vegetation, and structures) then assessing the contrast introduced by the project in terms of the basic design elements of form, line, color, and texture (BLM Manual 8431, Visual Contrast Rating).

The degree of contrast introduced by a proposed project with landscape elements is then rated as none, weak, moderate, or strong as shown in **Table 18**, Degree of Contrast Rating. The purpose of this method is to reveal elements and features that cause the greatest visual impact, and to guide efforts to reduce the visual impact of a proposed action or activity. This process is described in detail in Handbook H-8431-1, Visual Resource Contrast Rating, and documented using BLM Form 8400-4. Visual Contrast Ratings Worksheets, a map depicting key observation point (KOP) locations, and photograph logs for the potential impacts the proposed project may have on visual quality are provided as **Appendix E**, KOP Locations, Visual Contrast Rating Worksheets, and Photo Logs.

Table 18
Degree of Contrast Rating

Degree of Contrast	Criteria	Conformance with VRM Class
None	The element contrast is not visible or perceived	VRM Class I-IV
Weak	The element contrast can be seen but does not attract attention	VRM Class II-IV
Moderate	The element contrast begins to attract attention and begins to dominate the characteristic landscape	VRM Class III-IV
Strong	The element contrast demands attention, will not be overlooked, and is dominant in the landscape	VRM Class IV only

Source: BLM Handbook H-8431-1, Visual Resource Contrast Rating

Key Observation Points

Five KOPs were chosen for visual contrast rating analysis, as summarized in **Table 19**, Key Observation Points. KOP locations are shown in **Appendix E,** Figure E-1.

From each KOP, the viewshed can be divided into three distinct distance zones: the foreground, mid-ground, and background, as summarized in **Table 20**, Key Observation Point Viewsheds.

Table 19
Key Observation Points

KOP #	Location[1]	Distance from Project	Perspective Provided
KOP 1	Point along Dixie Valley Road	Approximately 5 miles south-southwest of power generation plants; 800 feet west of the southern gen-tie.	Provides the first distant view of the proposed plants for motorized travelers heading north from Highway 50 on Dixie Valley Road.
KOP 2	Point along Dixie Valley Road	Approximately 0.5 miles south-southwest of power generation plants.	Provides representative view of power generation plants from Dixie Valley Road near plants, traveling north.
KOP 5	Point along Dixie Valley Road	Approximately 0.5 miles north of power generation plants.	Provides representative view of power generation plants from Dixie Valley Road near plants, traveling south.
KOP 6	Point along Dixie Valley Road	Approximately 2.5 miles northeast of power generation plants and 750 feet north of the northern gen-tie.	Provides representative view of the new northern gen-tie as it parallels the existing transmission line.
KOP 8	Point along Dixie Valley Road	Approximately 16 miles northeast of power generation plants and 750 feet north of the northern gen-tie.	Provides representative view of the new northern gen-tie where not paralleling the existing transmission line.

[1] The UTMs for each KOP are in **Appendix E**.

Table 20
Key Observation Point Viewsheds

KOP #	Foreground	Mid-ground	Background
KOP 1	Open, relatively smooth, flat, slightly concave valley floor sloping east. Vegetation is composed primarily of indistinct mixed salt desert scrub, which is low, uniform, and continuous with predominate colors of yellows, grays, light tans or browns, and seasonal greens.	The landscape features are the same as the foreground, with the exception that there is a power line crossing the view from the northeast to the southwest.	Rugged terrain comprised of the flanking ranges. Ridges and canyons and pyramidal, angular shapes provide dark and light contrasts from shadows and exposed rock coloration. Colors are dark browns, reds, and grays.
KOP 2	Open, relatively smooth, flat, slightly concave valley floor sloping east toward the Humboldt Salt Marsh. Vegetation is indistinct mixed salt desert scrub, which is low and even but discontinuous with predominate colors of yellow, grays, light tans or browns, and occasional greens.	Humboldt Salt Marsh, an unvegetated playa feature in the topographic low of the valley. There is a power line visible.	Rugged terrain of the Clan Alpine Range comprised of ridges and canyons and pyramidal, angular shapes that provide dark and light contrasts from shadows. Predominant colors are dark browns and grays.
KOP 5	Open, relatively smooth, flat, slightly concave valley floor sloping east toward the valley floor. Vegetation indistinct mixed salt desert scrub, which is low and even but discontinuous with predominate colors of yellow, grays, light tans or browns, and occasional green.	Similar to foreground; partially obscured by mineral materials development. There is also a power line visible crossing the view from the southwest to the northeast.	Rugged terrain of the Stillwater Range comprised of ridges and canyons and pyramidal, angular shapes that provide dark and light contrasts from shadows. Predominant colors are dark browns and grays.
KOP 6	Open, relatively smooth, flat, slightly concave valley floor. Vegetation is composed primarily of indistinct mixed salt desert scrub, which is low, uniform, and continuous with predominate colors of yellow, grays, light tans or browns, and seasonal greens. There is a gravel road visible.	Same as foreground, except the gravel road is not in the mid-ground, but there is a power line crossing the view from west to east.	Rugged terrain comprised of the Stillwater Range. Views are of small ridges and canyons and pyramidal, angular shapes that provide dark and light contrasts from shadows and exposed rock coloration. Predominant colors are dark browns, reds, and grays.

KOP #	Foreground	Mid-ground	Background
KOP 8	Nearly flat valley floor, which is open and relatively smooth. Vegetation indistinct mixed salt desert scrub, which is low, uniform, and continuous with predominate colors of yellow, grays, light tans or browns, and seasonal greens. A gravel roadway bisects the view from west to east.	Open, smooth, slightly concave valley center. Vegetation indistinct mixed salt desert scrub, which is low, uniform, and continuous with predominate colors of yellow, grays, light tans or browns, and seasonal greens. A gravel roadway bisects the view from west to east.	Rugged terrain comprised of the Clan Alpine Range. Views are of small ridges and canyons and pyramidal, angular shapes that provide dark and light contrasts from shadows and exposed rock coloration. Predominant colors are dark browns, tans, and grays.

3.11.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)

The Proposed Action for visual resources is to establish interim VRM objectives for the project area until such time as permanent objectives are designated in the ongoing Carson City District Resource Management Plan revision (Carson City RMP). Once the Carson City RMP is final, the management decision regarding VRM would supersede the interim VRM objectives established through this EA should they vary.

The visual contrast rating analysis for all five KOPs found the project components would be visible and create a contrast with the surrounding landscape. The proposed power plant(s), wells, transmission lines, and aboveground pipelines would introduce additional visual disturbances and structural elements into the landscape. However, there are already existing utility poles and lines, Dixie Valley Road, a gravel site, other human-made structures, fence lines, and other areas with exposed natural sediment that influence the visual landscape throughout the project area and Dixie Valley.

The predominant vegetation is under 3 feet in height and would not screen the proposed 75-foot-tall power plant or 85-foot-tall transmission line power poles. Vegetation could provide visual buffering of ground disturbance associated with well pads and access roads.

Temporary Construction Impacts

There would be temporary impacts on visual resources during the 12- to 24-month construction period for the power plant(s), gen-tie, and ancillary facilities. Primary impacts would be associated with the presence of heavy equipment, including large tractor-trailer trucks, and equipment laydown. Using previously disturbed areas for equipment laydown sites would minimize impacts on visual resources from the presence of equipment.

Drilling equipment would be seen from Dixie Valley Road. Roads, drill pads, and laydown areas are near ground level and would not affect visual resources. During the approximately 45-day drilling process for each exploration well, the top of the drill rig would be up to 170 feet above the ground surface, depending on the drill rig used. During drilling operations, the rig would be visible at distances of greater than 1 mile from the respective drill sites, and lights used when drilling at night would increase rig visibility. All drill rig and well test facility lights would be limited to those required to safely conduct the operations, and they would be shielded and/or directed in a manner that focuses direct light to the immediate work area. Visual resource impacts from drilling would be temporary.

Equipment used for construction of a portion of the gen-tie route would be visible from Dixie Valley Road. Construction impacts would be minor and short-term and would be consistent with VRM Class III objectives.

Long-term Impacts

Long-term impacts would include up to approximately 111 acres of surface disturbance from the construction of the gen-tie, power plant(s), and ancillary facilities that would not be reclaimed following construction.

All newly constructed structures would be below 85 feet tall, and the power plant(s), pipelines, wellheads, pump motors, and motor control buildings would each be painted consistent with BLM visual guidelines to blend with the area and minimize visibility. The fence constructed around each of the production well sites would also be painted an appropriate color to blend with the area. Painting these features a shade of desert tan, or similar color, would promote visual blending and minimize contrast with the surrounding landscape.

The proposed power line and associated H-frame pole structures would generally not extend above the horizon line as viewed from the KOPs. This would avoid the potential for the proposed feature to contrast with the landscape lines and form.

Additionally, since the publication of the 2017 draft EA, ORNI 32 relocated one of the proposed power plant sites, in part, to minimize visual impacts from KOPs.

Long-term impacts would also include the visibility of artificial light at night from facility lighting. Lights could be visible to travelers on Dixie Valley Road, especially from KOPs 2 and 5. Following "dark sky"-compliant lighting practices (**Appendix J**) would minimize the potential for artificial light to extend beyond the project area. These practices include screening light sources to prevent upward- or outward-shining light, hooding and shielding light fixtures, directing light sources toward the pertinent site, locating light sources in building soffits, and locating light sources to avoid light pollution onto adjacent lands as viewed from a distance.

The southern 16 miles of the gen-tie would parallel an existing 230 kV transmission line. Where the proposed line diverges from the existing line to the northeast, it would parallel existing gravel roads for approximately 31 miles. Gen-tie towers would be 55 to 70 feet high, with some towers extending to 85 feet tall. The visual impact of the northern 31 miles of the line would be greater than the southern portion that would parallel the existing line; this is because the towers and line would be new structural elements visible to travelers on Dixie Valley Road. For viewers looking north and south along the roadway, the visual presence of the road in the foreground and mid-ground already influences the visual environment. The addition of the power line would incrementally increase the degree to which non-natural structural elements influence and contrast with the surrounding desert landscape.

In sum, the facilities constructed for the Proposed Action would be noticeable to sensitive receptors but would not dominate their view. The presence of other disturbances and structural elements already influences the visual landscape. The proposed power plant(s), wells, pipelines, and power line would be an incremental change from those existing conditions. Aligning the power line to follow existing linear features and painting the exterior of the power plant(s) and ancillary features a color the blends with the surrounding landscape would minimize the extent of additional visual contrast associated with those features.

As the degree of contrast and modification imposed on the landscape by the project would fall within the parameters of VRM Class III objectives, the project would be in conformance with VRM guidelines and policy. Further, installation of the prescribed lighting types, along with properly shielded lighting, would limit the amount of artificial light from the project. These mitigations would limit impacts from lighting on the dark skies and limit light impacts on local wildlife populations.

Alternative 1 (Southern Gen-tie Route)

Impacts on visual resources from the power plant(s), wells, and pipelines would be the same as under the Proposed Action. The nature and types of impacts from the gen-tie would be similar to those under the Proposed Action, with the exception that the line would parallel the existing Oxbow transmission line for its entire route, thus limiting changes to the characteristic landscape as viewed from KOPs 1, 2, 5, and 8. The line would not be visible from KOP 8.

Construction and operation of the southern gen-tie would be consistent with VRM Class III objectives. Long-term impacts would include up to approximately 117 acres of surface disturbance (including the power plant[s] and ancillary facilities). Gen-tie towers and the transformer site would be visible to travelers on Dixie Valley Road. As viewed from KOP 1, the power line would protrude above the skyline looking south where the background mountains are relatively lower in elevation.

In sum, the facilities of Alternative 1 would be noticeable to sensitive receptors but would not dominate their view. The presence of other disturbances and structural elements already influences the visual landscape. The proposed power plant(s), wells, pipelines, and power line would be an incremental change from those existing conditions. Aligning the power line to follow an existing power line and painting the exterior of the power plant(s) and ancillary features a color the blends with the surrounding landscape would minimize the extent of additional visual contrast associated with those features.

As the degree of contrast and modification imposed on the landscape by the project would fall within the parameters of VRM Class III objectives, the project would be in conformance with VRM guidelines and policy. Further, installation of the prescribed lighting types, along with properly shielded lighting, would limit the amount of artificial light from the project. These mitigations would limit impacts from lighting on the dark skies and would limit light impacts on local wildlife populations.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the Proposed Action, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. As such, there would be no change in existing visual resource conditions at the site.

3.12 CULTURAL RESOURCES

3.12.1 Affected Environment

The National Historic Preservation Act of 1966, as amended (NHPA), and the Archaeological Resources Protection Act of 1979 (ARPA) are the primary laws regulating preservation of cultural resources. Section 106 of the NHPA requires federal agencies to consider the effects of their actions on properties listed or eligible for listing on the NRHP. Regulations codified in 36 CFR 800 define how eligible properties or sites are to be dealt with by federal agencies or other involved parties. These regulations apply to all federal undertakings and all cultural resources.

The ARPA sets a broad policy that archaeological resources are important locally, regional, and to the nation, and should be protected. The purpose of the ARPA is to secure the protection of archaeological resources and sites that are on public lands and Native American lands. The law applies to any agency that receives information that a federally assisted activity could cause irreparable harm to prehistoric, historic, or archaeological data. This law provides criminal penalties for prohibited activities.

Additionally, in the State Protocol Agreement Between the Bureau of Land Management, Nevada and the Nevada State Historic Preservation Office (Protocol), the BLM CCD would ensure that historic properties that may be affected by any undertaking are identified and evaluated in accordance with the procedures established in Section 5.A. These include conducting an inventory for all historic, archaeological, cultural, or prehistoric resources within the area of potential effect (APE).

Cultural resources the BLM sought to identify include historic and prehistoric sites and may include structures, archaeological sites, or religious sites of importance to Native American cultures. Archaeological and historic resources are defined as follows:

> . . . the physical evidences of past human activities, including evidences of the effects of that activity on the environment. Factors identifying age, location and context of a site may make it culturally significant when looked at in conjunction with its capacity to reveal information through the investigatory research designs, methods, and techniques used by archaeologists (NPS 1998).

Ethnographic resources are defined as follows:

> [Any] . . . site, structure, landscape, object 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).

In accordance with the Protocol, the BLM identified and evaluated sites of religious and cultural significance to Native American tribes within the APE.

Section 5.B.5 of the Protocol states the following:

> Provisions for evaluation extend to properties of religious and cultural significance to Indian tribes. The BLM Manager makes eligibility determinations based on consultation with affected Indian tribes and on recommendations made by CRSs [cultural resource specialists]. BLM provides SHPO the opportunity to review and concur with the determinations. BLM also acknowledges that Indian tribes possess special expertise in assessing the eligibility of historic properties that may possess religious and cultural significance. BLM's consultation process should follow the latest Manual and associated Handbook, as well as appropriate Information Memoranda and Information Bulletins relaying guidance on tribal consultation protocols from the Washington Office or [Nevada State Office].

In order to identify cultural and ethnographic resources within the project area, in accordance with applicable laws and protocols, the BLM CCD obtained information through inventories conducted by cultural resource management firms, formal government-to-government consultation with Native American tribes, information sharing between the FPST and BLM cultural staff, and ethnographic investigations conducted for traditional tribal territories, including the project APE.

To identify archaeological resources, the BLM CCD required ORNI 32 to contract cultural resource management firms to conduct permitted and authorized cultural resource investigations. In 2011, ORNI 32 contracted Western Cultural Resource Management to conduct a cultural resource inventory of approximately 3,239 acres for the project on lands administered by the CCD Stillwater Field Office (1,835 acres) and the Winnemucca District Office Black Rock Field Office (1,303 acres), on Navy land (100 acres), and on 1 acre of private land (Western Cultural Resource Management 2014). In 2016, ORNI 32 contracted Abercrombie's Archaeological Consultants, LLC (AAC) to conduct a cultural resources inventory of approximately 629 acres on lands administered by the CCD Stillwater Field Office and the Winnemucca District Office Black Rock Field Office.

The inventories resulted in the identification and documentation of 59 previously undocumented archaeological sites and the documentation of 76 isolated finds. Of the newly documented sites, 42 are prehistoric, 13 are historic, and 4 are multicomponent.

Four of the previously recorded sites had been previously determined eligible for inclusion on the NRHP, and the BLM determined that these sites retain their eligibility. Of the newly documented sites, eight are recommended eligible to the NHRP and three are recommended as unevaluated.

On November 7, 2014, the BLM CCD submitted for SHPO review the cultural resource reports (8110/LLNVC0100/CRR3-2597[P]; SHPO Undertaking 2015-3448 #19762). The BLM CCD also sought SHPO concurrence for NRHP eligibility for recorded sites that the BLM CCD recommended as ineligible for inclusion on the NRHP and that it determined needed no further action. Additionally, the BLM CCD requested SHPO concurrence on the eligibility determination of 11 sites and stated no cultural resources or historic properties would be impacted by the undertaking.

In a letter dated January 6, 2015, the SHPO concurred with the BLM CCD determination of sites not eligible for NRHP listing. It also concurred with the BLM CCD's determination of eligibility of the 11 sites.

In order to identify ethnographic resources and traditional religious and sacred sites, the BLM CCD obtained information through formal government-to-government consultation with the FPST (see **Chapter 5**, Coordination and Consultation); information sharing between BLM CCD archaeologists and FPST cultural staff; and an ethnography that documented sacred sites and TCPs within the APE (Ethnographic Synthesis and Context for the Carson City District Office, BLM, NV [CRR 3 -2653]). As a result, the BLM CCD recorded the Dixie Meadows Hot Springs site (CNV-03-10543/CrNV-03-E0286) as a historic property eligible for the NRHP under the Secretary of the Interior's significance Criterion A.

The BLM CCD determined that the Western Shoshone and Northern Paiute traditionally use the spring for ceremonial and healing purposes (Fallon Paiute-Shoshone Tribe Consultation 2010–2021); the spring is a sacred locality that is important to maintaining Western Shoshone and Northern Paiute traditional cultural beliefs and practices. As additionally documented in the ethnographic report, the Dixie Hot Springs has been used as a traditional ceremonial place and a place critical to tribal traditional ceremonies, practices, and healing rituals.

The BLM CCD determined that the hydrological conditions are a contributing element to the site's eligibility and significance. Existing hydrological conditions are described in **Section 3.3.1**.

The BLM also determined that the ethnobiotic resources found at Dixie Hot Springs are a contributing factor to the site's eligibility, and continue to play an important part in maintaining cultural traditions. Plants containing medicinal or utilitarian properties are dispersed in or near the spring and are important in maintaining the cultural identity of the Western Shoshone and Northern Paiute.

3.12.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)

This section identifies the project's potential effects on sites eligible for the NRHP, as described above, and provides mitigation measures to eliminate or reduce their effects.

Through surface-disturbing activities, the Proposed Action could adversely affect sites eligible to the NRHP by damaging, destroying, or displacing artifacts and features, and constructing modern features out of character with a historic setting. The Proposed Action also has the potential to destroy or reduce natural or cultural features that are considered an ethnographic resource or sacred site.

The Proposed Action could change the site's hydrological condition. The potential impacts on hydrological conditions are described in **Section 3.3.1**. If the adaptive management response and mitigation, as described in Section 3.9 of the ARMMP (**Appendix H**) have not mitigated potential significant changes to the hydrological conditions at the site, the BLM could determine additional adverse effects on the site.

Indirect impacts on cultural resources would include changing the character of the property's use or physical features in the property's setting, and introducing visual, atmospheric, or audible elements that diminish the integrity of the property's features.

Construction of a geothermal plant, well pads, and associated facilities would place modern features onto a landscape that did not have them previously. This would thereby juxtapose modern industrial features onto a historic or traditional landscape.

In consultation with the SHPO and the FPST, the BLM CCD determined that the Proposed Action will have an adverse effect on the Dixie Meadows Hot Springs site, a historic property with traditional religious and cultural significance to the FPST, which is eligible for the NRHP under Criterion A. The adverse effects include visual (see **Section 3.11.2**) and auditory indirect effects from the presence of power plants, the potential for significant change to the hydrological condition of the Dixie Hot Springs (see **Section 3.3.2**), and potential alteration of ethnobotanical plant communities; all of these are critical components of the site's eligibility.

As a result, the BLM and SHPO agreed to enter into a MOA to resolve the adverse effects on the site (see **Appendix K** for a copy of the MOA). Through consultation and coordination with the SHPO, the FPST the Advisory Council of Historic Preservation, and the Navy, the BLM obtained resolutions to adverse effects on the site, and executed the MOA among the Bureau of Land Management, the Department of the Navy, the Advisory Council on Historic Preservation, and the Nevada State Historic Preservation Officer regarding the Dixie Meadows Development Project, Churchill County, Nevada.

The resolutions to adverse effects on the site contained in the MOA include:

- Development of a historic properties treatment plan that will contain elements including:
  - A plan to compile ethnographic and archaeological information of potential traditional cultural properties (TCPs) located within Dixie Valley
  - A plan to prepare appropriate site forms recording potential TCPs within Dixie Valley, including evaluations of TCPs for inclusion on the NRHP
  - A plan to prepare necessary forms and develop appropriate documentation sufficient to nominate eligible TCPs to the NRHP
  - A plan to locate and design an exclosure fence around the site, adequate to protect the site from new impacts from livestock
  - A plan for improved trail access to the site, so members of the public can more easily access the site
  - A plan for the development of an interpretive kiosk at the site

    - A plan to annually assess the health of ethnobotanical plant communities identified at the site during government-to-government consultation
- A discovery and unanticipated effects plan that would:
    - Require ORNI 32 to comply with 36 CFR 800.13(b) if previously unknown cultural resources are discovered
    - Require ORNI 32 to comply with 36 CFR 800.13(b) if unanticipated effects on historic properties, other than the site, are discovered
    - Require an assessment of additional adverse effects on the site if changes in the hydrological conditions at the site meet the thresholds and triggers for a significant change, as identified in Section 3.7 of the ARMMP (**Appendix H**) and if the adaptive management response and mitigation, as described in Section 3.9 of the ARMMP, have not mitigated the significant change to the hydrological conditions at the site.
- A requirement to hire at least one archaeological monitor during construction on previously undisturbed land and adhere to the tribal monitor provisions, as set forth in Attachment C of the MOA (**Appendix K**).

The Proposed Action would have no additional significant, adverse effect on districts, sites, highways, structures, or objects listed on or eligible for listing on the NRHP. Any areas containing cultural resources of significance would be avoided, or the potential for impacts would be mitigated in a manner acceptable to the BLM. If potential historic properties are discovered, or unanticipated effects on historic properties are found, the BLM will implement the Discovery and Unanticipated Effects Plan included as Attachment B of the MOA (**Appendix K**).

These measures, in combination with the implementation of geothermal lease stipulations and applicant-committed EPMs, are sufficient to mitigate the adverse effects on the NRHP-eligible and unevaluated resources in the project area. As a result, there would be no significant unmitigated effects on cultural or historic resources.

ORNI 32 has agreed to standard operating procedures for environmental protection (**Section J.1, Appendix J**) that include knowingly not disturbing, altering, injuring, or destroying any ethnographic or archaeological site, structure, building, object, or artifact, regardless of NRHP eligibility. ORNI 32 is responsible for ensuring that employees, contractors, or any others associated with the project do not damage, destroy, or vandalize ethnographic or archaeological sites.

Alternative 1 (Southern Gen-tie Route)

Impacts would be the same as described under the Proposed Action, with the exception that the southern gen-tie alignment would contribute to an incremental change in the visual landscape compared with the existing development in the Dixie Valley. Under Alternative 1, the gen-tie would be taller than it would be under the Proposed Action; however, it would parallel an existing power line, thereby reducing the potential for new impacts on NRHP-eligible site associated with visual quality.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the Proposed Action, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. As such, there would be no adverse effect on any of the recorded or possibly buried cultural resources or to the NRHP-eligible site.

3.13 NATIVE AMERICAN RELIGIOUS CONCERNS

3.13.1 Affected Environment

The federal government works on a government-to-government basis with Native American tribes as they are recognized to be separate governments. This relationship was formally recognized on November 6, 2000, with Executive Order 13175 (65 *Federal Register* 67249). As a matter of practice, the BLM coordinates with all tribal governments, associated Native American communities, Native American organizations, and tribal individuals whose interests might be directly and substantially affected by activities on public lands. In addition, Section 106 of the NHPA requires federal agencies to consult with Native American tribes for undertakings on tribal lands and for historic properties of significance to the tribes that may be affected by an undertaking (36 CFR 800.2(c)(2)). BLM Manual 1780, Tribal Relations, and BLM Handbook H-1780-1, Improving and Sustaining BLM-Tribal Relations, provide guidance for Native American consultations.

This section describes the coordination process between the BLM and Native Americans, identifies the Native American resource areas of interest, and identifies the project's potential effects on Native American concerns.

The American Indian Religious Freedom Act requires federal agencies to consider Native American religious values and the views of Native American tribal leaders.

Federal agencies are required to identify religious and sacred sites of importance to Native American cultures. The BLM has defined these sites as ethnographic resources, as defined below:

"[Any] . . . site, structure, landscape, object 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).

In accordance with Section 5.A.4 of the Protocol, the BLM is required to identify and evaluate for significance ethnographic sites. Section 5.B.5 of the Protocol states the following:

"Provisions for evaluation extend to properties of religious and cultural significance to Indian tribes. The BLM Manager makes eligibility determinations based on consultation with affected Indian tribes and on recommendations made by CRSs [cultural resource specialists]. BLM also acknowledges that Indian tribes possess special expertise in assessing the eligibility of historic properties that may possess religious and cultural significance. BLM's consultation process should follow the latest Manual and associated Handbook, as well as appropriate Information Memoranda and Information Bulletins relaying guidance on tribal consultation protocols from the Washington Office or NSO [Nevada State Office]."

Executive Order 13175 stipulates that during the NEPA process, federal agencies must consult tribes identified as being directly and substantially affected. Toward this end, the BLM has coordinated and consulted with Native American tribal representatives in the project area throughout the project timeline (see Section 5.1). This process has provided tribal entities the opportunity to identify ethnographic resources and the potential effects the project may have on Native American interests.

The BLM CCD has identified the FPST as having traditional territory that overlaps with the project area, as well as being a user of natural and cultural resources within the project area. The BLM has coordinated and consulted with FPST tribal representatives throughout the project timeline. Consultation between the FPST and the BLM CCD for geothermal projects in Dixie Valley began on April 13, 2007, when geothermal lease parcels surrounding Dixie Meadows were analyzed for the Competitive Geothermal Lease August Sale (DNA/2002EA-NV-030-02-021), and a consultation letter was sent to the FPST. Numerous meetings and field trips to consult and communicate on geothermal proposals for Dixie Meadows were held between 2010 and 2021.

A summary and timeline of consultations, coordination, and meetings conducted for geothermal projects at Dixie Meadows can be found in **Chapter 5**. Included are additional government-to-government consultation dates, informational meetings, correspondence, and field trips with the FPST; consultation dates and formal communication with the Nevada SHPO; and coordination and correspondence with other partners.

In addition to the government-to-government consultation with the FPST, the BLM sought to identify ethnographic resources through inventories conducted by cultural resource management firms, information sharing between the FPST and BLM cultural staff, and ethnographic investigations conducted for traditional tribal territories, including the project APE.

In accordance with Section 5.A.4 of the Protocol, the BLM sought to identify ethnographic resources with an ethnographic study that included the project area. This study, titled *Ethnographic Synthesis and Context for the Carson City District Office, BLM, NV* [CRR 3-2653], involved the following:

- Research of published ethnographies and history and unpublished archives
- Interviews with ethnographers and agency personnel with experience in the area
- A series of meetings and interviews with Western Shoshone and Northern Paiute tribal representatives
- Presentations to tribal councils
- Focused interviews and field trips with individuals knowledgeable about the history of land use and traditions associated with the project area

Meetings and interviews were open-ended but guided by the research questions. They focused on identifying historic properties and potential TCPs. The study included three tasks: identifying primary contacts; identifying issues, potential properties, and areas of concern; and reporting the results. The resulting collaborative report was based on the observations of the cultural specialists; it identified sites potentially eligible as Western Shoshone and Northern Paiute historic properties and TCPs. It used these as a basis for identifying potential effects from the project and to propose mitigation.

Resulting from the BLM's effort to identify ethnographic resources, the BLM recorded the Dixie Meadows Hot Springs site (CNV-03-10543/CrNV-03-E0286) as a historic property eligible for the NRHP under the Secretary of the Interior's significance Criterion A. The FPST traditionally used the spring for ceremonial and healing purposes (FPST Consultation 2010–2021); the site is a sacred locality and important to maintaining Western Shoshone and Northern Paiute traditional cultural beliefs and practices. As documented in the ethnographic report, the Dixie Hot Springs complex has been used as a traditional ceremonial place; it is a place critical to tribal traditional ceremonies, practices, and healing rituals.

The BLM determined that the hydrological conditions are a contributing element to the site's eligibility and significance. **Section 3.3.1** describes existing hydrological conditions. The BLM also determined that the ethnobiotic resources found at Dixie Hot Springs are a contributing factor to the site's eligibility, and continue to play an important part in maintaining cultural traditions. Plants containing medicinal or utilitarian properties are dispersed in or near the spring and are important in maintaining the cultural identity of the Western Shoshone and Northern Paiute.

The BLM obtained additional information regarding FPST religious values and the views of FPST leaders. In a letter provided to the BLM CCD dated February 12, 2021, the FPST provided extensive information regarding tribal views and use of the site; the letter also provided an interview with a tribal elder and stated that the project has the potential to impact the tribe's religious expression, citing the American Indian Freedom Religion Act (42 USC 1996).

3.13.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)

This section identifies the project's potential effects on Native American concerns. It also provides recommended mitigation measures and resolution of adverse effects to avoid or reduce potential impacts on Native American religious concerns.

The Proposed Action would have impacts on Native American concerns and the tribe's religious expression, if it resulted in any of the following outcomes:

- Preventing access to the ethnobiotic resources or to the Dixie Hot Springs
- Significantly changing the hydrological resources of the site, as described in **Section 3.3.1**
- Reducing the ethnobiotic resources at Dixie Hot Springs, such that the resource area would be adversely impacted by the construction, operation, or maintenance of the power plant(s) or the transmission line
- Resulting in noise levels from geothermal production that preclude religious expression or ceremonial use of the site
- Obstructing the view of Job Peak from the Dixie Meadows Hot Springs site, due to construction of the power plant(s), transmission lines, or other project components

Through government-to-government consultation with the FPST, the BLM obtained and considered Native American religious values and the views of Native American leaders. The BLM evaluated policies and procedures with the aim of protecting Native American religious freedom and refraining from prohibiting access and performance of religious ceremonies. The BLM consulted with the FPST in regard to the Proposed Action.

The BLM, in consultation with ORNI 32, has redesigned the project to avoid, lessen, or minimize adverse audible or visual impacts and to avoid unnecessary interference with tribal religious practices.

Through consultation and coordination with the SHPO, the tribe, the Advisory Council of Historic Preservation, and the Navy, the BLM obtained resolutions to adverse effects on the site and agreed to enter into a MOA to resolve the adverse effects on the site (see **Section 3.12**, Cultural Resources for more information and **Appendix K** for a copy of the MOA).

The Proposed Action would have no additional significant, adverse effect on districts, sites, highways, structures, or objects listed on or eligible for listing on the NRHP. Any areas containing cultural resources of significance would be avoided, or the potential for impacts would be mitigated in a manner acceptable to the BLM. If potential historic properties are discovered, or unanticipated effects on historic properties are found, the BLM will implement the Discovery and Unanticipated Effects Plan included as Attachment B of the MOA.

Hydrogeologic conditions described in **Section 3.3** and **Appendix L** indicate the Proposed Action would not influence spring flow at the Dixie Hot Springs or other springs at Dixie Meadows. Implementing the adaptive management and/or mitigation measures described in Section 3 of the ARMMP (**Appendix H**) in response to any detections of potential changes to the water quantity of springs, seeps, and groundwater aquifers based on extensive geothermal, groundwater well, and surface water (springs and seeps) monitoring (as described in Sections 3.1 and 3.2 of the ARMMP [**Appendix H**]) would avoid, minimize, or mitigate any adverse impacts on the Dixie Hot Springs.

The Proposed Action incorporates several EPMs to avoid or lessen the impacts on Native American religious concerns. These include:

- Avoidance of known archaeological sites during construction of facilities and transmission line (see **Section 3.12**, Cultural Resources)
- Requiring at least one archaeological monitor and one tribal monitor to ensure the avoidance of all known and potentially unknown archaeological and cultural sites
- Redesigning the project to move the location of one power plant farther south and the transmission line farther east from the Dixie Meadows Springs to lessen impacts on religious expression and adverse effects on the site
- Not authorizing the closing of access roads related to this project. The BLM would maintain public access to the important traditional use and gathering sites.

- Requiring a fence enclosing the plants in the vicinity that are important to the FPST. The fence would keep livestock out of the springs and surrounding area, but allow other species to still use the springs.
- Monitoring the health of ethnobotanicals that are identified by the FPST and located at the site for a period of 6 years
- Developing a spring monitoring plan as part of the ARMMP (**Appendix H**) that would consist of collecting representative temperature, flow rate, and basic chemistry samples of the spring, and also temperature, pH, and level measurements of the groundwater. The monitoring schedule would include quarterly testing. The collected data would be reported to the BLM in written form annually within 30 days of the end of each calendar year, together with an interpretation of the monitoring data collected during the preceding calendar year. The BLM would evaluate if significant changes to the springs that cannot be mitigated would constitute an additional adverse effect on the site.
- Requiring the installation of an educational interpretive kiosk at the site

These measures, in combination with the implementation of geothermal lease stipulations, applicant-committed EPMs, and the MOA (**Appendix K**) are sufficient to avoid, lessen, or minimize Native American religious concerns in the project area. As a result, there would be no significant unmitigated effects on Native American religious concerns.

Alternative 1 (Southern Gen-tie Route)

Impacts would be the same as those described under the Proposed Action, with the exception that the southern gen-tie alignment would contribute to an incremental change in the visual landscape compared with the existing development in the Dixie Valley and result in 6 more acres of permanent disturbance. Under Alternative 1, the gen-tie would be taller than it would be under the Proposed Action; however, it would parallel an existing power line, thereby reducing the potential for new impacts on Native American concerns associated with visual quality.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the Proposed Action, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. As such, there would be no impact on Native American Religious Concerns.

3.14 TRAVEL MANAGEMENT

3.14.1 Affected Environment

As described in **Section 2.1.4**, primary site access is by driving about 40 miles east from Fallon on US Highway 50 and then north on State Highway 121 (Dixie Valley Road) for approximately 36 miles. The road is mostly used to access ranches, military installations, and the Terra-Gen Dixie Valley Geothermal Power Plant.

Roads in the immediate project vicinity include the Dixie Valley Road and a network of smaller unpaved roads on BLM-administered land. Road uses include motorized recreation, access to hunting areas, and administrative and permitted use. The project area has not been formally designated as open, closed, or limited for motorized travel and is managed like an "open" OHV area, meaning cross-country travel is allowed.

3.14.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)

Construction could temporarily conflict with public access along roads in the project area. Specifically, vehicles may be delayed during construction of the gen-tie where it parallels existing roads. Access may also be affected by the number of construction vehicles traveling to and from the site, especially if larger and heavier vehicles are traveling at slower speeds. Construction would not restrict access to other areas (e.g., the WSA and the northern Dixie Valley area); no existing access roads would be closed.

Due to the small number of vehicles needed for operation, there would be no long-term impacts on travel management.

Alternative 1 (Southern Gen-tie Route)

Impacts would be the same as under the Proposed Action.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the Proposed Action, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. As such, there would be no impact on travel management.

3.15 LAND USE AUTHORIZATIONS

3.15.1 Affected Environment

There are several ROWs located within one mile of the proposed project site and the proposed gen-tie. Types of ROWs include transmission and communication lines, roads, a seismic station site, and water monitoring wells. In addition, the geothermal lease area also contains mineral rights to 760 acres of Navy land known as the Lamb Mineral interests. ORNI 32 owns these mineral rights.

Approximately 16 miles of the southern gen-tie route in Alternative 1 are located on Navy land. The Navy performs a variety of activities in the Dixie Valley, including low-level supersonic flights, long-range navigation training on routes near the project site, combat search and rescue training via helicopter, and other trainings at the Dixie Valley Training Area south of this project site.

Approximately 26.7 miles of the southern gen-tie route would be located within an area that has been segregated from all forms of appropriation under the public land laws, including the mining laws, mineral leasing laws, and geothermal leasing laws, subject to valid existing rights. The BLM has segregated this area in response to an application received from the Navy for a withdrawal expansion for military use of the Naval Air Station Fallon, Fallon Range Training Complex in Churchill County, Nevada. The segregation is in effect for a period of 2 years from September 2, 2016, unless the application/proposal is cancelled or approved prior to that date. On August 31, 2018 (date of publication in the *Federal Register*), Public Land Order No. 7873 withdrew 8,722.47 acres of Navy lands in the Dixie Valley area from all forms of appropriation under the public land laws, including location and entry under the United States mining laws, and leasing under the mineral and geothermal leasing laws, subject to valid existing rights. The public land order is in effect for a period of 4 years.

3.15.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)

The Navy performs training activities that include operating aircraft under low-level and supersonic conditions in the Dixie Valley region. Prior to commencement, ORNI 32 would notify the Navy of operations that may pose a hazard to training activities. Potential impacts on Navy activities in Dixie Valley are reviewed by the Federal Aviation Administration if the impact exceeds or conflicts with flight obstruction specifications found in 14 CFR 77.13. The Proposed Action would not exceed or conflict with the flight obstruction specifications.

The Proposed Action would not conflict with existing ROWs or uses granted within them. The BLM would notify all ROW holders in the area of the proposed project and ensure that the proposed project does not negate rights granted to them. Because the project would not impact existing ROWs, exceed or conflict with flight obstruction specifications, or result in degradation of existing roads or access to public and Navy lands, impacts on land use authorizations are not anticipated.

Alternative 1 (Southern Gen-tie Route)

If the southern gen-tie route is approved by the BLM Authorizing Officer, the BLM would strongly desire concurrence from the Department of the Navy that the land use authorization would not conflict with the segregated lands proposed use. Other impacts would be the same as under the Proposed Action.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the Proposed Action, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. As such, there would be no impact on land use authorizations.

3.16 Wilderness Study Areas

3.16.1 Affected Environment

The north and northwest boundary of the Combined Dixie Meadows Geothermal Unit area is adjacent to the southern and eastern edge of the 94,607-acre Stillwater Range WSA, as shown in **Figure 10**.

3.16.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)

ORNI 32 is not proposing any activity within the Stillwater Range WSA. Therefore, direct impacts are not anticipated.

BLM Manual 6330, Management of Wilderness Study Areas requires an analysis of impacts from activities outside of WSAs. The manual also requires mitigation of impacts "to the extent consistent with best management practices and applicable law" (BLM 2012c).

Because of the Proposed Action's proximity to the WSA boundary, construction and operation activities could impact wilderness characteristics inside the WSA. Lighting, noise, construction of new facilities, and associated transportation and dust could affect solitude and primitive and unconfined recreation inside the WSA, diminishing the naturalness character of the WSA. Construction-related impacts would last only for the duration of construction.

Implementing the EPMs described in **Appendix J** would avoid, minimize, or mitigate potential impacts on the naturalness character of the WSA. These EPMs include applying water to reduce dust; reclaiming areas of temporary disturbance; using a BLM-approved, weed-free seed mix; using specific paint colors to minimize visibility of new facilities; adhering to "dark sky"-compliant lighting practices; adhering to a speed limit of 25 miles per hour; and utilizing noise-minimizing equipment and design. Application of these measures would result in less than significant indirect impacts on the WSA.

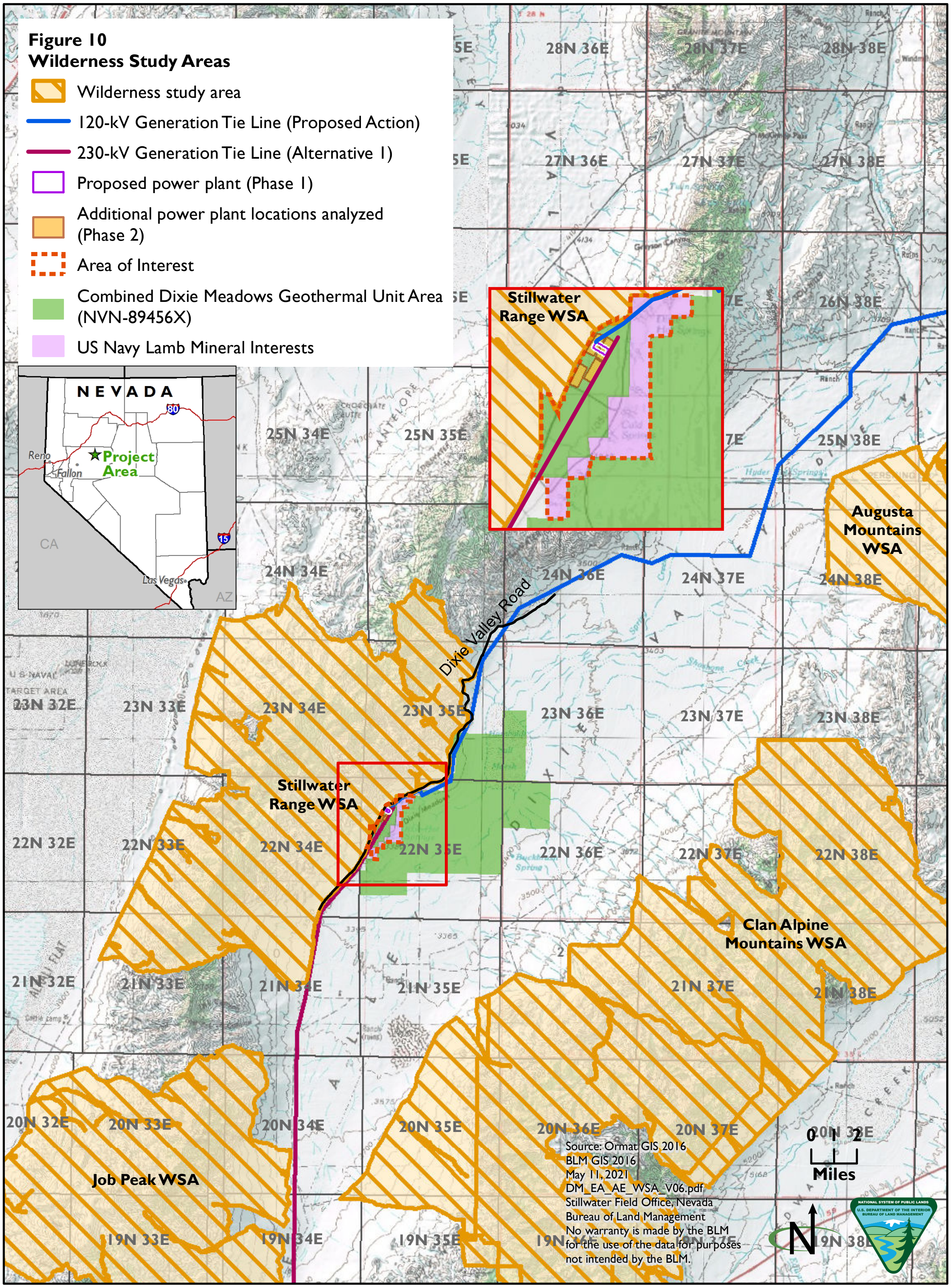

Figure 10
Wilderness Study Areas
Wilderness study area
120-kV Generation Tie Line (Proposed Action)
230-kV Generation Tie Line (Alternative 1)
Proposed power plant (Phase 1)
Additional power plant locations analyzed (Phase 2)
Area of Interest
Combined Dixie Meadows Geothermal Unit Area (NVN-89456X)
US Navy Lamb Mineral Interests
NEVADA
Reno
Fallon
Project Area
CA
AZ
Las Vegas
Stillwater Range WSA
Augusta Mountains WSA
Clan Alpine Mountains WSA
Job Peak WSA
Dixie Valley Road
28N 36E
28N 37E
28N 38E
27N 36E
27N 37E
27N 38E
26N 38E
25N 34E
25N 35E
25N 38E
24N 34E
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19N 33E
19N 34E
19N 35E
19N 38E
Source: Ormat GIS 2016
BLM GIS 2016
May 11, 2021
DM_EA_AE_WSA_V06.pdf
Stillwater Field Office, Nevada
Bureau of Land Management
No warranty is made by the BLM for the use of the data for purposes not intended by the BLM.
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ORNI 32 performed a cadastral survey in the project area which clearly defined the boundaries of the WSA. As a result, the Proposed Action is not required to conform with BLM Manual 6330, which requires an approximately 660-foot setback, or facility modification, for fluid mineral developments that could affect WSA characteristics. Proposed infrastructure, such as well pads and power plant(s), are not required to be set back by a minimum amount of 660 feet from the WSA.

The non-impairment standard in BLM Manual 6330 stipulates that no new ROWs will be approved for uses that would impair the suitability of such areas for future preservation as wilderness. The Proposed Action would conform with BLM Manual 6330. The proposed gen-tie parallels an existing transmission line and county road (Dixie Valley Road) through Dixie Meadows. Given the proposed ROW's location relative to existing infrastructure and the design features to minimize visual impacts (see **Appendix J**), the proposed ROW placement would not violate the non-impairment standard.

Alternative 1 (Southern Gen-tie Route)

Impacts would be the same as under the Proposed Action.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the Proposed Action, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. As such, there would be no impact on WSAs.

3.17 PUBLIC HEALTH AND SAFETY AND HAZARDOUS MATERIALS

3.17.1 Affected Environment

Solid waste would include cleared vegetation and other waste materials and debris from construction areas. No hazardous wastes occur in the project area, and the proposed project would not generate, use, or dispose of any hazardous waste. Diesel fuel, oil, and lubricants would be used on vehicles traveling on roads in the project area. Any wastes that may be generated by the production facilities would be properly disposed through a licensed recycler or disposal company.

Fenced reserve pits would be constructed in accordance with BMPs identified in the BLM Gold Book (BLM 2007a) and NDOW Geothermal Sump Guidelines (NDOW no date) on each pad for the containment and temporary storage of water, drill cuttings and waste drilling mud during drilling operations. The reserve pit would measure approximately 75 feet by 250 feet by as many as 10 feet deep.

3.17.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)

Waste materials and debris from construction areas would be collected, hauled away, and disposed of at approved landfill sites. A covered portable dumpster would be kept on-site to contain trash.

Constructing reserve pits in accordance with the BLM Gold Book (BLM 2007a) and NDOW Geothermal Sump Guidelines (NDOW no date) would reduce the risk of accidental release of water, drill cuttings and waste drilling mud during drilling operations. Reserve pits would only be used for water, drill cuttings, and waste drill mud; no solid or other waste would be deposited in reserve pits.

Any spill of hazardous waste or hydrocarbons would be remediated by following all local, state, and federal regulations.

Diesel fuel, lubricants, hydraulic fluids, and drilling chemicals would be transported to, stored on, and used by the project at the proposed drill sites. The project would conform with state and federal regulations for transporting and handling any hazardous or regulated materials. Materials transported, stored, and used may include drilling mud gel (bentonite clay), salt, barite, tannathin (lignite), lime (calcium hydroxide), caustic soda (sodium hydroxide), diesel fuel, lubricants (motor oil and compressor oil), hydraulic fluid, anti-freeze (ethylene glycol), and liquid polymer emulsion (partially hydrolyzed polyacrylamide/polyacrylate).

Diesel fuel, oil, and lubricants would be used on vehicles traveling on roads in the project area. Gas and/or diesel may be stored in the project area in a tank with secondary containment that reduces the potential for spills. Typical of most construction projects, storage and use of these materials may result in minor, incidental spills of diesel fuel or oil to the ground during operations or refueling. Other incidental spills could be associated with equipment failure (e.g., hydraulic hose rupture). The spill or discharge contingency plan (**Appendix J**) would be followed for cleanup and abatement of any petroleum product or other hazardous material. Therefore, neither short- nor long-term impacts from solid or hazardous waste from the proposed project are expected.

Alternative 1 (Southern Gen-tie Route)

Impacts would be the same as under the Proposed Action.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the Proposed Action, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. As such, there would be no impact on public health and safety and hazardous materials.

3.18 SOCIOECONOMICS

3.18.1 Affected Environment

The proposed project as described in the Proposed Action, including the geothermal lease area, power plant(s), and majority of the gen-tie route, is located primarily in Churchill County, Nevada. A portion of the gen-tie in the Proposed Action would be located in Pershing County, but no workers are expected to reside in Pershing County. (In Alternative 1, the entire project would be located in Churchill County.)

According to the United States Census, the population of Churchill County in 2014 was estimated at 23,989, with 9,253 households. This is a decrease of 3.6 percent from the 2010 population of 24,877 people. The population of Churchill County comprises 5.1 percent of the Nevada statewide population (US Census 2014a). The county seat and closest city to the spill or discharge contingency plan is Fallon, which has a population of 8,349 (US Census 2014b). The city is home to NAS Fallon and is located approximately 43 miles southwest of the spill or discharge contingency plan.

As of August 2015, the unemployment rate in Churchill County was 6.8 percent, which was the same as the Nevada rate of 6.8 percent and higher than the United States rate of 5.2 percent (Nevada Workforce Informer 2015). The average annual per capita income in Churchill County is $24,716, which is less than the state average of $26,589 (US Census 2014a).

During well drilling and construction of the power plant(s), substation, and gen-tie, a temporary workforce of up to approximately 50 workers would utilize services in and likely commute from their homes in Churchill County.

3.18.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)

Construction and operation would result in short-term increases in employment in Churchill County. Because of the relatively small number of employees needed for construction and operation, there would be a negligible change in county-wide unemployment and per capita income. Most employees are anticipated to be local residents and therefore there is no anticipated impact on housing in Churchill County.

Construction and operation of the proposed facilities would generate additional tax revenue from sales taxes collected on indirect spending for construction materials and induced spending from workers buying items. Mineral royalties would also be collected as the geothermal resource is utilized. All of these revenue streams would benefit the county by increasing the amount of tax collected.

The northern portion of the gen-tie would be located in Pershing County. It is anticipated that there would be no impacts on socioeconomics in Pershing County because no workers are expected to reside in Pershing County and no taxes or royalties would be collected in Pershing County.

Alternative 1 (Southern Gen-tie Route)

The project footprint and geographic scope of impacts would be entirely contained in Churchill County. Impacts would be the same as those described under the Proposed Action.

No Action Alternative

Under the No Action Alternative, the BLM would not approve the Proposed Action, the facilities would not be constructed, and ORNI 32 would likely suspend exploration activities authorized under the two previous Decision Records for the foreseeable future. As such, there would be no short- or long-term employment, sales taxes or mineral royalties generated by the proposed project.

3.19 ENVIRONMENTAL JUSTICE

3.19.1 Affected Environment

The environmental justice analysis area includes Churchill and Pershing Counties, as well as the FPST Reservation and Colony.

Low-Income Populations

The CEQ guidance on environmental justice (CEQ 1997) defines low-income populations based on the US Census Bureau's annual statistical poverty thresholds. The 2019 poverty threshold is based on total income of $13,300 for an individual (under 65 years of age) and $25,926 for a family of four (US Census Bureau 2020a). The CEQ guidance does not specify percentage guidelines for defining a population as low income; for this analysis, this is defined as an area where the number of individuals living below the poverty line exceeds 50 percent of the total population, or if the percentage of the low-income population is meaningfully greater (10 percentage points) than the percentage below poverty in the comparison population.

Based on best available data, none of the counties have been identified for potential environmental justice consideration; however, the FPST Reservation and Colony meet the criteria for individuals and families living in poverty, as shown in **Table 21**. This is due to meaningfully greater levels of low-income individuals and families than in Nevada, which is used as the reference population.

Table 21
Low-Income Populations

Area	Individuals in Poverty, 2018 (Percent)	Families in Poverty, 2018 (Percent)	Median Household Income
Churchill County	12.8	8.5	$51,514
Pershing County	15.1	11.8	$50,846
FPST Reservation	32.4	24.4	$36,250
FPST Colony	37.8	33.3	$24,375
State of Nevada	13.7	9.8	$57,598

Source: US Census Bureau 2020b

Minority Populations

CEQ guidance defines a minority population as one where an individual group or the aggregate population of all minority groups combined exceeds 50 percent of the total population, or if the percentage of the population comprising all minority groups is meaningfully greater (10 percentage points) than the minority population percentage in the broader region.

As shown in **Table 22**, Nevada has a higher aggregate minority population (at 47.3 percent) than the analysis area counties. As a result, no racial or ethnic minority populations have been identified for further environmental justice consideration.

Table 22
Minority Population Demographics

Population	Churchill County (Percent)	Pershing County (Percent)	State of Nevada (Percent)
Total population	24,010	6,611	2,922,849
Hispanic or Latino	3,260 (13.6)	1,597 (24.2)	831,597 (28.5)
White	20,192 (84.1)	5,369 (81.2)	1,935,103 (66.2)
Black or African American	588 (2.4)	292 (4.4)	261,123 (8.9)
American Indian or Alaska Native	1,074 (4.5)	269 (4.1)	35,845 (1.2)
Asian	663 (2.8)	92 (1.4)	234,693 (8)
Native Hawaiian and Other Pacific Islander	50 (0.2)	30 (0.5)	19,352 (0.7)
Other Race	531 (2.2)	315 (4.8)	296,234 (10.1)
Two or More Races	912 (3.8)	244 (3.7)	140,499 (4.8)
Aggregate Minority Population	5,635 (23.5)	2,280 (34.5)	1,382,610 (47.3)

Source: US Census Bureau 2020c

Native American Populations

The BLM identified the FPST as having religious or cultural affiliation in the analysis area. Tribal consultation is ongoing, as described in **Section 3.13**, Native American Religious Concerns.

3.19.2 Environmental Consequences

Proposed Action (Northern Gen-tie Route)

As described in **Section 3.13**, Native American Religious Concerns, Dixie Meadows holds cultural and spiritual importance to the members of the FPST. Environmental justice effects could result if the Proposed Action were to prevent access to, or reduce the abundance or extent of, the ethnobiotic resources; prevent access to the Dixie Hot Springs; or reduce or alter the flow, temperature, or chemical composition of the water at the Dixie Hot Springs. It is possible that the construction, operation, and maintenance of the project may disturb or destroy the flow rate, temperature, chemical composition, or other factors relevant to the Dixie Hot Springs. Moreover, these actions may adversely disturb or destroy culturally important ethnobiotic resources.

To avoid these potential effects, the BLM has conducted government-to-government consultation with the FPST. As a result of consultation, the BLM developed a MOA (**Appendix K**) to be signed by the Navy, ORNI 32, the FPST, the SHPO, and the BLM to minimize potential adverse effects. The BLM has also proposed mitigation for potential adverse impacts on culturally important ethnobiotic resources; this mitigation includes identifying, avoiding, and field-checking rare resources to ensure effects are avoided during construction. Further, to maintain public access to important areas, the BLM would not close access roads related to this project. Trail access to sites would be improved so elderly members of the public can more easily access the sites.

Geothermal development could alter the flow or temperature of springs important to the traditional cultural lifeways of the FPST, as described in **Section 3.13**. To avoid this impact, ORNI 32 would comply with all measures to avoid impacts on water resources, as outlined in **Appendix J**, including implementation of the ARMMP (**Appendix H**).

Although there could be short-term, construction-related impacts on all populations, including area low-income populations, the impacts would not be disproportionately focused on these populations. Further, potential impacts would be concentrated in the Dixie Meadows area; there are no residential dwellings in the vicinity. Given this, no short-term construction-related effects are anticipated.

Alternative 1 (Southern Gen-tie Route)

Effects would be the same as those described for the Proposed Action.

No Action Alternative

Under the No Action Alternative, environmental justice conditions would not change; existing conditions, as described above, would continue.

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Chapter 4. Cumulative Impacts

The CEQ issued revisions to the NEPA, which become effective on September 14, 2020 (40 CFR 1508.1(g)), including elimination of cumulative impacts from the scope of the effects analysis. Because the draft EA was published prior to the revised NEPA regulations, cumulative impacts are analyzed.

Cumulative impacts are defined by the CEQ in 40 CFR 1508.7 (1978) as "impacts on the environment which result from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." Cumulative impacts can result from individually minor but collectively significant actions taking place over time. The analysis area for the cumulative impact analysis is the same as the analysis area for each resource found in **Chapter 3**, Affected Environment and Environmental Consequences.

4.1 Past, Present, and Reasonably Foreseeable Future Actions

Past actions considered are those whose impacts on one or more of the affected resources have persisted to present day. Present actions are those occurring at the time of this evaluation and during implementation of the Proposed Action. Reasonably foreseeable future actions constitute those actions that are known or could reasonably be anticipated to occur within the analysis area for each resource, within a time frame appropriate to the expected impacts from the Proposed Action. For the Proposed Action, the time frame for potential future action is assumed to be the duration of the lease, or approximately 40 years. The primary past, present, and reasonably foreseeable future actions that would contribute to cumulative impacts of the Proposed Action include continued use of existing unpaved roads, continued exploration and development of geothermal resources within leased areas, continued use of existing land use authorizations, livestock grazing and ranching, dispersed recreation, and military training activities. Specific past, present, and reasonably foreseeable actions include the following:

The Terra-Gen Power Geothermal Exploration EA and Dixie Meadows Geothermal Exploration EA were approved in June 2010 and January 2012, respectively. Combined, the two EAs analyzed and permitted up to 34 well pads (with multiple wells on each pad), 205.6 acres of surface disturbance on BLM-administered lands, and 4 acres of surface disturbance on the Navy's Lamb Mineral Interests. Two groundwater wells were also approved. To date, seven wells (three full-size and four exploration wells) have been drilled (see **Figure 4**).

The Comstock Geothermal Exploration Project, proposed in the Dixie Valley approximately 30 miles to the north of the proposed Dixie Meadows geothermal project, would include the drilling and testing up to 10 geothermal exploration wells. There would be approximately 49 acres of disturbance from proposed well pads and access roads. The BLM CCD is preparing the draft EA for the project.

TGP operates the 230 kV Oxbow transmission line that extends to the south from the Dixie Valley Power Plant and through the Dixie Meadows project area. Under Alternative 1, the proposed Dixie Meadows 230 kV gen-tie would parallel the existing Oxbow line. Cumulative visual impacts would be reduced compared with the Proposed Action; however, the southern line would require a 30 percent larger disturbance footprint.

Dixie Valley Road provides access to Navy facilities, other geothermal development facilities, backcountry recreation areas, and ranching and grazing lands.

Portions of four livestock grazing allotments overlap the project area: the Boyer Ranch Cottonwood Valley, Dixie Valley, Jersey Valley, and South Buffalo allotments. Navy training activities, including Night Vision Device aircraft operations, long range navigation training, combat search and rescue training via helicopter, and other training activities, occur at the Dixie Valley Training Area south of the project area.

An area of the southern portion of the Dixie Valley has been segregated from all forms of appropriation under the public land laws, including the mining laws, mineral leasing laws, and geothermal leasing laws, subject to valid existing rights, for a period of 2 years from September 2, 2016. On August 31, 2018 (83 *Federal Register* 44654), Public Land Order No. 787378737873 extended the 2016 temporary segregation for a period of 4 years. It is reasonably foreseeable that the Navy would obtain approval from Congress to withdraw this area for the next 20 to 30 years for use by the Navy for testing and training involving air-to-ground weapons delivery, tactical maneuvering, use of electromagnetic spectrum, land warfare maneuver, and air support, as well as other defense-related purposes consistent with these purposes (81 *Federal Register* 58919).

On August 31, 2018 (date of publication in the *Federal Register*), Public Land Order No. 7873 temporarily withdrew (for 4 years) 8,722.47 acres of Navy lands in the Dixie Valley area from all forms of appropriation under the public land laws, including location and entry under the United States mining laws, and leasing under the mineral and geothermal leasing laws, subject to valid existing rights. The public land order is in effect for a period of 4 years.

4.2 AIR QUALITY

Past, present, and reasonably foreseeable future actions have impacted and would continue to impact air quality in the cumulative impact analysis area. Construction for geothermal energy development and various administrative rights-of-way for roads and overhead transmission lines and development of minerals material sites have caused adverse impacts on air quality from an increased potential for fugitive dust.

Implementation of the Proposed Action or Alternative 1, in combination with other actions in the Dixie Valley, would increase the potential for fugitive dust, especially during construction when ground-disturbing actions occur. These impacts would be temporary and result in no cumulative air quality impacts. ORNI 32 would apply dust control measures, as discussed in **Section 3.2.2**. The assumption is that other projects or actions occurring on BLM-administered lands would be subject to similar requirements. As a result, cumulative impacts on air quality would be minimized.

4.3 WATER RESOURCES

Past, present, and reasonably foreseeable future actions that have impacted and would continue to impact water resources include exploration and development of geothermal resources, livestock grazing, and recreation.

Several existing geothermal developments operate within Dixie Valley, and numerous studies over the past several decades have been undertaken to better understand the geothermal resources there (Bergman et al. 2014). As described in detail in **Section 3.3.2**, in circumstances where geothermal development has a direct hydrologic connection to the geothermal resource, production and injection would have the potential to change the water quality, water quantity, and/or temperature of surface water expressions. Flow testing could also have these types of impacts, but to a lesser extent. For example, a decrease in the Jersey Valley Hot Spring surface expression has been observed as a result of unknown factors. This could be attributed to record drought conditions, utilization activities at the Jersey Valley Power Plant, or a combination of these and other factors. Geothermal reservoir testing described in **Appendix L** and flow testing described in **Appendix M** have not identified that the Dixie Valley or Piedmont Faults, from which the project would utilize geothermal resources, contribute to the surface discharges at Dixie Meadows. Accordingly, there is no evidence to support that the proposed geothermal development would contribute to cumulative impacts on water resources, including the source waters for warm and hot springs in Dixie Meadows.

Consumptive groundwater for construction water could similarly alter surface water expressions with a hydrologic connection to shallow groundwater aquifers. There would be little potential for these types of impacts because the 17.6 acre-feet for 1 year of construction would be obtained from a private source and trucked to the site.

Other approved past, present, and future uses of the lands and resources, such as grazing, may contribute to impacts on the quality of surface waterbodies in the area. Livestock tend to congregate where surface water is present; this is due to the availability of water and forage late into the season, potentially contributing to declines in water quality. These areas are also popular for dispersed recreation; vehicles, hikers, and equestrian use can also contribute to water quality impacts.

Implementation of the Proposed Action or Alternative 1, in combination with past, present, and reasonably foreseeable actions in Dixie Valley, has the potential to cumulatively affect the water quality, quantity, and/or temperature. Effects would occur if geothermal utilization changed the shallow groundwater aquifer quality or quantity, or resulted in changes to the surface water quantity or quality at seeps and springs in Dixie Meadows. This could affect water quality or availability in Dixie Meadows for wildlife and water rights holders.

4.3.1 Mitigation Measures and Adaptive Management Tools

EPMs and mitigation measures would be required for any BLM-approved activities on public lands, to avoid, prevent, or minimize such impacts on water quality resources, or the continued functioning of certain waterbodies or other geothermal surface expressions, such as hot springs. Implementing the adaptive management and/or mitigation measures described in Section 3.9 of the ARMMP (**Appendix H**) would minimize cumulative impacts on water resources. Implementation of these measures would initiate actions to respond to any indication of changes to water quality, temperature, or volume, flow; chemistry; or other indication of function of the springs and seeps based on the monitoring described in Section 3 of the ARMMP (**Appendix H**).

Additional mitigation measures developed in accordance with the ARMMP or as implemented as conditions of approval, to be found in the Decision Record, developed and required by the BLM, and based upon the lease stipulations, could include shutting down the operation (see the EPMs in **Appendix J**). This would further avoid the potential for changes to water temperature or flow.

4.4 SOIL RESOURCES

Past, present, and reasonably foreseeable future actions have impacted and would continue to impact soil resources in the cumulative impact analysis area. Construction for geothermal energy development and various administrative rights-of-way for roads and overhead transmission lines and development of minerals material sites have caused adverse impacts such as increased potential for wind- or water-driven soil erosion during high wind or precipitation events.

Ground-disturbing activities associated with the Proposed Action and Alternative 1, in combination with similar actions elsewhere in the Dixie Valley, would result in the potential for cumulative impacts on soil resources. These impacts would include the increased potential for wind- or water-driven soil erosion during high wind or precipitation events. Implementation of the EPMs in **Appendix J** for the Dixie Meadows project would reduce these potential cumulative impacts by minimizing disturbance and requiring timely reclamation of temporarily disturbed areas. While soil erosion measures would be in place, localized soil erosion would be expected; this is because of the amount of existing and proposed disturbance, typically dry soil conditions, and the occurrence of high winds and infrequent but strong precipitation events in the Dixie Valley. When combined with other reasonably foreseeable future actions, the Proposed Action would result in an incremental addition to soil resource-related impacts. It is assumed that other developments on BLM-administered land in the Dixie Valley would adhere to similar requirements, thus minimizing cumulative impacts on soil resources.

When combined with past, present, and reasonably foreseeable future actions, implementing the mitigation measures for hydric soils outlined in **Appendix J** (see **Section J.2.2**), which primarily include avoiding surface disturbance in areas with hydric soils, would reduce the potential for cumulative impacts in those sensitive soil locations. Per the ARMMP (Section 3.3 in **Appendix H**), ORNI 32 would monitor hydric soils at tier-1 hydrological monitoring sites. Monitoring results would further inform the need for adaptive management and mitigation to avoid, minimize, or mitigate cumulative impacts on hydric soils.

4.5 Vegetation

Past, present, and reasonably foreseeable future actions have impacted and would continue to impact vegetation in the cumulative impact analysis area. Construction of various administrative rights-of-way for roads and overhead transmission lines, minerals material sites, and monitoring wells have also impacted vegetation. Impacts include the removal or alteration of the native vegetation cover during construction and to a lesser extent during maintenance of these facilities.

Based on the analysis of direct and indirect impacts, the Proposed Action would permanently disturb approximately 111 acres of vegetation. Disturbed areas are primarily associated with temporary work areas for the gen-tie. These work areas would utilize previously disturbed areas (such as the existing road that parallels much of the proposed gen-tie alignment) when feasible to reduce vegetation impacts. Incorporating additional EPMs (see **Appendix J**) would further reduce vegetation impacts. These include minimizing vegetation removal to the extent feasible during construction, interim reclamation following construction, and final reclamation following site decommissioning. Reclamation would be conducted to the standards in the BLM's 2008 geothermal leasing PEIS.

Combined with the past, present, and reasonably foreseeable future actions, the proposed project would only have a minor cumulative contribution to vegetation impacts.

4.6 Migratory Birds, Wildlife and Key Habitat, and Sensitive Species

Past, present, and reasonably foreseeable future actions have impacted and would continue to have impacts on migratory birds, wildlife, and sensitive species. These resources could be adversely affected by displacement or disruption of normal behavioral patterns. In particular, construction, and project operations and maintenance for geothermal energy development may have the greatest potential to adversely affect wildlife and habitat. Energy development in the region, including existing geothermal developments in Dixie Valley and associated electrical transmission facilities, could fragment habitats, decrease aquatic habitat suitability, and disrupt wildlife movement corridors. In addition, some of these projects and actions could increase traffic, conflicts with humans, and competition for habitat niches.

Past, present, and reasonably foreseeable future actions have impacted and would continue to impact sensitive wildlife species and their habitats, including aquatic species like the Dixie Valley pyrg and Dixie Valley toad, which are only known to exist in the Dixie Valley. Past exploration and development of geothermal resources within leased areas, livestock grazing and ranching, and dispersed recreation may have impacted these species through disturbance and human presence and degradation of aquatic and riparian habitats. These actions have also impacted and would continue to impact sensitive avian species and migratory birds by habitat alteration or by removing nesting and/or foraging habitat. Low-flying military aircraft have also likely caused migratory bird mortality from collisions during routine Navy training; these effects may be increased if lands in Dixie Valley are segregated for Navy training. Overhead transmission lines have provided some nesting and perching habitat for raptor species but simultaneously increased predation of small mammals, reptiles, and ground-nesting bird species by raptors and corvids.

Contributions to cumulative effects on sensitive species would be greater for those species that are less tolerant of fragmented or disturbed habitats or those that have a reduced range, such as the Dixie Valley toad and Dixie Valley pyrg. While some general wildlife can inhabit relatively disturbed habitats and reoccupy temporarily disturbed and restored areas relatively quickly, sensitive species may not have this ability. Temporarily disturbed suitable habitat, even if restored, can take a relatively long time to regain suitability, and this does not guarantee species reoccupation.

Past, present, and reasonably foreseeable future actions have impacted and would continue to have impacts on sensitive plant species in the cumulative impacts analysis area. Actions with the greatest potential to impact sensitive plants are those involving surface disturbance, including energy exploration and development. These actions have resulted in removal of sensitive plant individuals and reduced habitat quality, including by facilitating weed establishment and spread.

Based on the analysis of direct and indirect impacts, the Proposed Action would cause a minimal change in noise levels and approximately 111 acres of habitat loss that would not be reclaimed following construction. Permanent impacts would be primarily limited to power plant(s) and substation, wells, construction of the gen-tie alignment, and access roads. Incorporating the BBCS (**Appendix C**), EPMs, and the ARMMP (summarized in **Appendix J**; included in its entirety in **Appendix H**) would minimize or avoid cumulative impacts on migratory birds, wildlife and key habitat, and sensitive species like the Dixie Valley toad. Specifically, avoiding ground disturbance in aquatic habitats, conducting preconstruction surveys for sensitive species, performing interim and final habitat reclamation, implementing seasonal restrictions for sensitive species, implementing water and biological resources monitoring and mitigation measures, clearing work areas for nesting birds and other sensitive resources prior to construction, implementing required design features for greater sage-grouse, and avoiding sensitive plant species would reduce the potential for cumulative impacts on sensitive species and their habitats.

As such, the proposed project would only have a minor contribution to cumulative impacts on migratory birds, wildlife and key habitat, and sensitive wildlife species within the analysis area. The proposed project would not contribute to cumulative impacts on sensitive plant species, when combined with past, present, and reasonably foreseeable future actions. Based on the anticipated potential impacts from the Proposed Action, when combined with impacts from past, present, and reasonably foreseeable future actions in the cumulative effects analysis area, no cumulatively significant impacts are anticipated.

Ongoing research related to the Dixie Valley toad, such as that by Halstead et al. 2021, and the proposed monitoring described in **Appendix H** would inform future management of activities in the Dixie Valley. The USFWS also may use the data in making a listing decision for the species.

4.7 Invasive, Nonnative, and Noxious Weeds

Past, present, and reasonably foreseeable future actions that have impacted and would continue to impact invasive, nonnative, and noxious weeds include exploration and development of geothermal resources, existing land use authorizations, and dispersed recreation including use of existing roads. Impacts associated with past and present actions would have included soil disturbance, which would have increased the potential for establishment and spread of invasive species. Use of existing roads and overland recreation increases potential for weed seed dispersal. Where past and present actions have been subject to reclamation requirements, the potential for invasive plant establishment and spread would be reduced.

Based on the analysis of direct and indirect impacts, the Proposed Action would temporarily disturb up to 1,934 acres, 1,823 acres of which would be reclaimed following construction. Disturbed areas are primarily associated with temporary work areas for the gen-tie. These work areas would utilize previously disturbed areas (such as the existing road that parallels much of the proposed gen-tie alignment) when feasible. ORNI 32 would control noxious weed populations by preparing and implementing an invasive plant management plan, minimizing surface disturbance during construction, and using a BLM-approved, weed-free seed mix during restoration of temporarily disturbed areas as summarized in **Appendix J**. Therefore, the Proposed Action would result in few additional impacts from noxious, invasive plant species and there would be little or no incremental increase in cumulative effects from noxious, invasive plant species from the Proposed Action.

4.8 Wetlands and Riparian Areas

Past, present, and reasonably foreseeable future actions that have impacted and would continue to impact wetlands and riparian areas include exploration of geothermal resources, livestock grazing, recreation, and invasive, nonnative, and noxious weed establishment and spread. As described in **Section 4.3**, Water Resources, geothermal development and consumptive groundwater extraction can result in changes to water quantity of surface water expressions; this can alter the extent or condition of associated wetlands and riparian areas. Livestock tend to congregate in wetland and riparian areas due to availability of water and forage late into the season, potentially contributing to reduced vegetation cover, weed spread, soil erosion, and water quality impacts. These areas are also popular for dispersed recreation; vehicles, hikers, and equestrian use can also contribute to noxious weed spread in wetlands and riparian areas.

Implementation of the Proposed Action or Alternative 1, in combination with past, present, and reasonably foreseeable actions in the Dixie Valley, has the potential to cumulatively affect wetlands and riparian areas. For example, depending on the hydraulic connection with the deeper geothermal resource, the volume and temperature of flows into springs and seeps that support wetland areas in the Dixie Valley could be altered by geothermal utilization, injection, or well flow tests, potentially altering wetland plant species composition, total wetland area, or surface or subsurface water levels in wetlands.

Development of well pads and the gen-tie may result in indirect impacts including wetland and riparian vegetation loss due to changes in site hydrology, and erosion and sediment transport into wetland areas. Soil disturbance associated with these activities and the past, present, and reasonably foreseeable future actions described above can contribute to weed spread, potentially into wetland areas, reducing their quality and function.

Implementing specific adaptive management responses according to aquatic resources monitoring, as described in the ARMMP (**Appendix H**), combined with other EPMs outlined in **Appendix J**, would reduce the likelihood for cumulative impacts on wetlands and riparian areas. EPMs would be implemented for all authorized actions on BLM-administered lands to avoid or reduce these impacts; as a result, cumulative impacts on wetlands and riparian areas would be minimized. Based on the anticipated potential impacts from the Proposed Action, when combined with impacts from past, present, and reasonably foreseeable future actions in the cumulative effects analysis area, no cumulatively significant impacts are anticipated.

4.9 VISUAL RESOURCES

Past, present, and reasonably foreseeable future actions that have impacted and would continue to impact visual resources include construction for geothermal energy development and various administrative ROWs for roads and overhead transmission lines, and proliferation of lighting that is not compliant with "dark sky" practices.

Implementation of the Proposed Action or Alternative 1, in combination with any additional reasonably foreseeable geothermal exploration and development facilities, would result in a change to the existing visual landscape through the introduction of geothermal power generation equipment and associated transmission infrastructure, as well as temporary and permanent lighting. The Proposed Action or Alternative 1 would alter the visual character of the Project Area. The cumulative projects considered in this analysis could potentially change the visual character of the area from rural, open space to a more developed feel both at the generating facilities and along transmission line routes. All newly constructed structures would be painted consistent with BLM visual guidelines to blend with the area and minimize visibility, and lighting would adhere to "dark sky" practices, which would minimize proliferation of improper lighting (**Appendix J**). As a result, cumulative impacts on visual resources would be minimized.

4.10 CULTURAL RESOURCES

Adverse effects on the integrity of setting of any subsequently identified National Register listed or eligible sites where integrity of setting is critical to listing or eligibility could occur from the establishment of geothermal development facilities, including well pads, roads, and plants. Construction activities could increase the likelihood of vandalism and illegal collecting/excavation of cultural sites (Eagles et al. 2002). These impacts on cultural resources could be reduced through the Section 106 process of the

NHPA. Mitigation measures requiring surveys for cultural resources prior to surface-disturbing activities, as required by the Proposed Action, would reduce the potential impacts on cultural resources, if implemented for the other actions.

Implementation of the MOA for the resolution of adverse effects (**Appendix A**) and continued communication with Native American tribes in order to assist each other in making decisions would significantly reduce or eliminate any adverse impacts on all cultural and ethnographic resources and activities.

As a result, cumulative impacts on cultural resources would be minimized.

4.11 Native American Religious Concerns

Over the last 15 to 20 years, the BLM and the tribes have witnessed an increase in the use of BLM-administered lands by various groups, organizations, and individuals. Livestock grazing; the pursuit of recreation opportunities; hunting; fishing; oil, gas, geothermal, and mining leasing, exploration, and development; OHV use; interpretive trails; and mountain biking are among many activities within the BLM CCD, Stillwater Field Office administrative boundary.

In addition to all the existing, growing, and developing uses of the public lands, fluid mineral leasing and exploration would continue to contribute to the general decline in sites and associated activities of a cultural, traditional, and spiritual nature.

The traditional lands of the FPST encompass the majority of the state of Nevada (including the BLM administrative area). It is imperative that the BLM and affected tribes remain flexible and open to productive and proactive communication in order to assist each other in making decisions that would reduce or eliminate any adverse impacts on all parties' interests, resources, and activities. This communication, reflected in part through government-to-government consultation on the EA (see **Section 5.1**) and the signing of an MOA for the resolution of adverse effects (**Appendix K**), has the potential to minimize cumulative impacts on Native American religious concerns.

4.12 Travel Management

The Proposed Action and Alternative 1 would introduce additional vehicles and traffic, primarily during the 12- to 24-month construction period. Combined with other past, present, and reasonably foreseeable future actions in the analysis area, there could be temporary and intermittent impacts on organized and competitive events. However, given the low level of traffic on area roads, and the fact that the Proposed Action would contribute a small number of vehicles to the area during operation, there would be negligible cumulative impacts on travel management when combined with impacts from past, present, and reasonably foreseeable future actions.

4.13 LAND USE AUTHORIZATIONS

The Proposed Action, Alternative 1, and any new ROWs in the Dixie Valley would be required to comply with adopted land use plans and zoning requirements. If Alternative 1 is approved, the BLM would desire to obtain concurrence from the Navy that the land use authorization would not conflict with the segregated lands proposed use. Therefore, these projects would be consistent with the overall land use policies of the BLM and Churchill and Pershing Counties and would not result in any cumulative effects that would be incompatible with existing or long-term land use patterns when combined with impacts from past, present, and reasonably foreseeable future actions.

4.14 WILDERNESS STUDY AREAS

Implementation of the Proposed Action or Alternative 1, in combination with other developments and vehicle travel in the Dixie Valley, would result in indirect cumulative impacts on the Stillwater Range WSA. Because these actions would not be noticeable from the mountainous interior of the WSA where solitude and naturalness are most prevalent, impacts would be minor when combined with impacts from past, present, and reasonably foreseeable future actions.

4.15 PUBLIC HEALTH AND SAFETY AND HAZARDOUS MATERIALS

Past, present, and reasonably foreseeable future actions may result in the accidental release of hazardous or solid wastes in the analysis area. Releases would be treated per local, state, and federal regulations and the use and storage of hazardous materials would follow BMPs. The Proposed Action or Alternative 1 would not result in short- or long-term impacts from solid or hazardous waste and would not contribute to any cumulative impacts on this resource. Worker training and exclusion fencing would minimize impacts on health and safety at the project site. Adherence to a 25mph speed limit would minimize impacts along Dixie Valley Road in the project area. As a result, cumulative impacts would be negligible when combined with impacts from past, present, and reasonably foreseeable future actions.

4.16 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

The Proposed Action would have a short-term beneficial cumulative effect from the creation of construction jobs during the construction period. Operation of the proposed facilities and any future energy generating facilities in the Dixie Valley would have a minor beneficial cumulative effect through the number of jobs created and the collection of mineral royalties when combined with impacts from past, present, and reasonably foreseeable future actions.

Past, present, and reasonably foreseeable future actions, as discussed in **Section 4.11**, Native American Religious Concerns, may continue to contribute to the general decline in sites and the associated activities of a cultural, traditional, and spiritual nature to the FPST. Government-to-government consultation with the FPST, resulting mitigation commitments made by the BLM (**Appendix J**) and signing a MOA (**Appendix K**) would serve to reduce or eliminate adverse environmental justice impacts. As a result, cumulative impacts would be minimized.

4.17 NO ACTION ALTERNATIVE

Under the No Action Alternative, the project site would not be developed for geothermal resources at this time and would be available for development in the future. There would be no impacts on any of the identified resources or activities from implementation of the No Action Alternative. As such, there would be no contribution to cumulative impacts on any of the identified resources from implementation of the No Action Alternative when combined with impacts from past, present, and reasonably foreseeable future actions.

Chapter 5. Consultation and Coordination

During the NEPA process for this EA, the BLM CCD formally and informally consulted and coordinated with other federal agencies, state and local governments, Native American tribes, and the interested public. The agency did this to ensure its compliance, in both the spirit and intent, with 40 CFR 1501.7, 1502.19, and 1503. In addition to formal scoping, the BLM implemented collaborative outreach and a public involvement process that included inviting agencies to be cooperative partners for the EA planning process.

5.1 GOVERNMENT-TO-GOVERNMENT CONSULTATION

The federal government works on a government-to-government basis with Native American tribes as they are recognized to be separate governments. This relationship was formally recognized on November 6, 2000, with Executive Order 13175 (65 *Federal Register* 67249). As a matter of practice, the BLM coordinates with all tribal governments, associated Native communities, Native organizations, and tribal individuals whose interests might be directly and substantially affected by activities on public lands. In addition, Section 106 of the NHPA requires federal agencies to consult with Native American tribes for undertakings on tribal lands and for historic properties of significance to the tribes that may be affected by an undertaking (36 CFR 800.2(c)(2)). BLM Manual 1780, Tribal Relations, and BLM Handbook H-1780-1, Improving and Sustaining BLM-Tribal Relations, provide guidance for Native American consultations.

Executive Order 13175 stipulates that during the NEPA process, federal agencies must consult tribes identified as being directly and substantially affected. The BLM has coordinated and consulted with FPST tribal representatives throughout the project timeline. Consultation between the FPST and the BLM CCD for geothermal projects in Dixie Valley began on April 13, 2007, when geothermal lease parcels surrounding Dixie Meadows were analyzed for the Competitive Geothermal Lease August Sale (DNA/2002EA-NV-030-02-021) and a consultation letter was sent to the FPST.

Consultation between the BLM and the FPST for geothermal projects in Dixie Valley continued on August 25, 2010, with a FPST Council request; a letter to the FPST including a project proposal, map, and request for information the FPST may have on cultural and ethnographic resources; and a face-to-face meeting.

Numerous meetings and field trips to consult and communicate on geothermal proposals for Dixie Meadows were held between 2010 and 2021. The following entries include additional government-to-government consultation dates, informational meetings, correspondence, and field trips with the FPST; consultation dates and formal communication with the Nevada SHPO; and coordination and correspondence with other partners.

Additional meetings with the FPST were conducted October 26, 2010; April 27, 2011; and July 28, 2011. Additional in-person meetings between BLM and FPST staff for the Dixie Meadows exploration phase were held on September 15, 2010; December 22, 2010; May 25, 2011; March 3, 2010; May 25, 2011; and May 23, 2013. Field trips to the Dixie Hot Springs with FPST staff for the development phase were conducted on April 10, 2015; March 25, 2015; and March 26, 2016.

On June 27, 2011, the BLM Nevada State Director, Amy Lueders, was briefed by BLM CCD management and staff about Ormat-Terra Gen Geothermal Projects.

Formal consultation with the Nevada SHPO for the project began November 7, 2014.

Project initiation for ORNI 32's geothermal development project was held by BLM CCD staff on June 22, 2015. A field trip to Dixie Meadows and the project location was conducted with BLM Stillwater Field Office staff, the BLM Stillwater Field Office field manager, and the BLM CCD district manager on April 28, 2016.

The BLM sent a letter, including a description of the proposed project, a map of the project location, and an invitation for comments or feedback regarding the project, to the FPST. The BLM sent an additional information request letter to FPST Chairman George on February 12, 2016, as BLM CCD staff received the draft EA.

During a formal government-to-government consultation meeting with the FPST Council on Tuesday, September 13, 2016, the BLM CCD provided a document to the tribe containing consultation results. The BLM CCD also provided the tribe with a mitigation plan to address concerns.

On September 28, 2016, a formal consultation meeting was conducted between members of the FPST Council, members of the FPST cultural committee, BLM

CCD staff members, and a representative from Ormat. The consultation resulted in a request by the FPST Council to meet with the BLM Nevada State Director, John Ruhs, and the BLM CCD Manager, Ralph Thomas. The FPST Council identified the following specific concerns about the undertaking:

- Adverse impacts on archaeological sites within the project APE
- Restricted access to the Dixie Hot Springs
- Impacts on plants at the Dixie Hot Springs that are traditionally used by the tribe
- Impacts on the Dixie Hot Springs, including the flow rate, temperature, pH, and change in chemical composition

At a meeting on September 29, 2016, the BLM informed the SHPO of an adverse effect determination on Dixie Meadows Hot Springs. The SHPO agreed to participate in developing a mitigation plan in a MOA.

On November 21, 2017, the BLM Nevada State Director, John Ruhs; the BLM's Brian Amme; BLM CCD Manager, Ralph Thomas; and BLM CCD archaeologist, Jason Wright, visited the Dixie Meadows Hot Springs site to discuss the undertaking and tribal concerns.

On February 8, 2017, the BLM CCD Manager, Ralph Thomas, and BLM archaeologist, Jason Wright, conducted government-to-government consultation with the FPST Council, as per the FPST request in September 2016.

On May 19, 2017, the BLM CCD provided a draft MOA to the SHPO containing resolutions to adverse effects on the Dixie Meadows Hot Springs site. The MOA contained resolutions to adverse effects, as recommended by the FPST cultural committee and the FPST Council.

On May 25, 2017, the BLM provided Mike Baskerville (Navy) a copy of the draft MOA. The draft was reviewed by the Navy's legal counsel.

On May 30, 2017, the SHPO reviewed the draft MOA and provided basic comments back to the BLM. The resolutions proposed in the MOA remained intact and unchanged.

On June 26, 2017, the BLM Stillwater Field Office invited the FPST to participate in a MOA for the resolution of adverse effects on historic properties (see the attached letter) and provided the tribe with a draft MOA detailing resolutions to adverse effects, which the tribe requested during consultation.

On June 26, 2017, the BLM provided the Navy an updated version of the draft MOA.

On June 27, 2017, the BLM Stillwater Field Office Field Manager, Ken Collum, and BLM Stillwater Field Office archaeologist, Jason Wright, attended a formal consultation meeting with the FPST Council. The BLM provided FPST attendees with a copy of the draft MOA and a copy of the invitation to participate letter.

On October 26, 2017, the BLM Stillwater Field Office received a letter from the FPST requesting the BLM abandon the current draft of the MOA.

On November 1, 2017, Nancy J. Brown (Advisory Council on Historic Preservation, Advisory Council on Historic Preservation liaison to the BLM) informed Jason Wright that the FPST has requested Advisory Council on Historic Preservation involvement in the project.

On November 3, 2017, BLM archaeologist Jason Wright met with SHPO Rebecca Palmer to discuss the FPST's letter to the BLM and the resolutions contained in the MOA.

On January 23, 2018, the BLM requested a formal government-to-government consultation meeting with the FPST Council to discuss the resolutions of adverse effects in the draft MOA.

On February 8, 2018, the BLM formally invited the ACHP to participate in the consultation to resolve adverse effects of the Dixie Meadows Geothermal Development Project.

On February 20, 2018, the BLM received notification from the ACHP (John Fowler) stating ACHP's participation in the project's consultation.

On February 26, 2018, the BLM provided a draft MOA to the ACHP. The BLM did not receive a response.

On April 4, 2018, the ACHP notified the BLM CCD that Christopher Wilson assumed Nancy Brown's role.

On April 20, 2018, the BLM CCD provided the ACHP with a final draft of the MOA for review. To date, the BLM has not received a response.

On April 19, 2019, the FPST provided the BLM CCD with a draft MOA.

ORNI 32 requested the BLM CCD assign the Dixie Meadows Geothermal Development Project a lower priority for processing the EA.

In February 2019, ORNI 32 requested the BLM CCD continue environmental review of the Dixie Meadows Geothermal Project.

On February 28, 2020, a draft MOA was provided to ORNI 32 for review.

On June 11, 2020, ORNI 32 provided MOA comments.

On June 24, 2020, the BLM CCD provided notification that the project was being reviewed, and a latest draft MOA was provided to the Navy, SHPO, and FPST.

On July 15 (email) and July 20 (call), 2020, the BLM CCD again requested feedback from the FPST.

On August 10, 2020, the FPST responded to the BLM CCD with a request for a conference call and field trip.

On October 15, 2020, the BLM coordinated a project update and MOA discussion call between Rochanne Down, FPST Cultural Director; Wyatt Golding, legal counsel for the FPST; Rebecca Palmer, SHPO; RJ Wright, ORNI 32; Ben Orcutt, ORNI 32; Mike Baskerville, Navy; Mike Waters, Navy; Ken Collum, BLM; Shevawn Sapp, BLM; and Jason Wright, BLM. The FPST requested simultaneous review of the ARMMP, once the draft was complete, and the draft MOA.

On November 15, 2020, the BLM returned the draft NEPA and ARMMP documents to the contractor for additional edits.

On November 17, 2020, Jason Wright and Wyatt Golding participated in a conference call for updates to the NEPA, ARMMP, and MOA timeline. Wright stated that the NEPA and ARMMP documents have been returned to the contractor for additional edits.

On December 7, 2020, the BLM CCD received another draft of the ARMMP and NEPA documents. A BLM hydrologist is conducting an internal review of the ARMMP, and the BLM interdisciplinary team is reviewing the NEPA document.

On January 4, 2021, the BLM CCD received a draft of the ARMMP from ORNI 32's contractor McGinley & Associates. During the call on October 15, 2020, the FPST requested simultaneous review of the ARMMP, when ready, and the existing draft of the MOA for resolution of adverse effects on Dixie Meadows Hot Springs.

On January 6, 2021, the BLM CCD provided the draft ARMMP and MOA to Alvin Moyle, FPST Chairman; Rochanne Downs, FPST Cultural Director; Richard Black, Environmental Director; and Wyatt Golding, FPST Counsel. The BLM CCD also provided the latest draft EA to the same tribal personnel.

On January 12, 2021, the BLM CCD released the draft EA for a 30-day public review.

On February 12, 2021, the FPST provided comments on the EA and ARMMP in a letter from Alvin Moyle, FPST Chairman. Chairman Moyle restated the tribe's concerns with the project's impact on the spring site and concerns regarding the American Indian Religious Freedom Act.

On June 8, 2021, the BLM CCD sent a letter to the FPST requesting tribal comments on the MOA.

On June 02, 2021, the BLM CCD requested a meeting with the FPST Council to further consult on the MOA and the Tribal concerns regarding the American Indian Religious Freedom Act.

On June 26, 2021, the BLM CCD received additional tribal comments on the MOA. The FPST also stated that the FPST Council would meet with the BLM on July 27, 2021, to consult on the Dixie Meadows Geothermal Development Project.

On July 2, 2021, the BLM CCD provided relevant consultation and project information and a draft of the MOA to Rebecca Palmer (SHPO), the Navy, and ORNI 32, requesting review.

On July 14, 2021, the BLM CCD provided the ACHP with a summary report detailing all tribal consultation, the resolution of adverse effects, coordination with the SHPO and the Navy, efforts to minimize adverse effects on the sites, and a copy of the MOA, requesting review.

On July 20, 2021, the BLM, SHPO, ACHP, Navy, ORNI 32, and the tribe met to discuss previous comments and provide new comments and edits to the draft MOA.

On July 27, 2021, an informational meeting was conducted between the BLM CCD and the FPST Council, including the BLM CCD's District Manager, Ken Collum; Stillwater Field Office Manager, Jake Vialpando; and archaeologist Jason Wright.

On August 9, 2021, a formal government-to-government consultation meeting was conducted between the BLM CCD and the FPST Council, including the BLM CCD's District Manager, Ken Collum; Stillwater Field Office Manager, Jake Vialpando; and archaeologist Jason Wright.

5.1 Agencies, Groups, and Individuals Contacted

The following agencies, groups, and individuals were contacted for the preparation of the draft EA:

Nevada Department of Wildlife (partner agency)

- Bonnie Weller, GIS Specialist, Biologist III
- Mark Freese, Western Region Supervising Habitat Biologist
- Jenni Jeffers, Western Region Wildlife Biologist

Nevada Natural Heritage Project

- Eric S. Miskow, Biologist III/Data Manager

State of Nevada Sagebrush Ecosystem Program

- Katie Andrle, Technical Team, Wildlife
- Kelly McGowan, Program Manager

US Fish and Wildlife Service (partner agency)

- Nevada Fish and Wildlife Office
- Northern Nevada Ecological Services Field Office
- Region 8 Migratory Bird Office

Department of the Navy, Naval Air Station Fallon (partner agency)

- Environmental Department

ORNI 32

- Mark Hanneman, Permitting Manager, Compliance
- RJ Wright, Environmental Permitting Specialist
- Jake Steinman, Manager, Environmental Permitting
- Erica Freese, Director, Permitting

Since the Proposed Action is being proposed as an expansion to the original Dixie Meadows exploration plan, and since the location is identical to that of the original project with no additional resource issues identified, consultation and coordination conducted for the original Dixie Meadows exploration project was incorporated into this EA.

5.2 List of Preparers

Table 23
List of Preparers

Name	Project Expertise
BLM Carson City District, Stillwater Field Office	
Melanie Hornsby	Planning and Environmental Planner and Military Liaison
Cassandra Rivas	Natural Resources
Dave Schroeder	Project Lead, Hazardous or Solid Wastes, Public Health and Safety
Jacob Vialpando	Acting Stillwater Field Office Manager
Jason R. Wright	Tribal Consultation, Cultural Resources, Native American Religious Concerns
Ken Collum	District Office Manager
Ken Depaoli	Geologist
Kira Lay	Land Use Authorizations
Matt Simons	Land Use Authorizations

Name	Project Expertise
Paul Amar	Visual Resources, Travel Management, Wilderness/Wilderness Study Areas
Mark Mazza	Invasive, Nonnative Species
Melanie Cota	Migratory Birds, Wildlife and Key Habitat, Sensitive Species, Threatened and Endangered Species
Michelle Stropky	Hydrologist, Water Resources, Water Quality (Surface/Ground), Wetlands/Riparian Zones, Soil Resources, Farmlands (prime or unique), Floodplains, Air Quality, Greenhouse Gas and Global Climate
Linda Appel	Vegetation
Shevawn Sapp	Assistant Field Office Manager
BLM Winnemucca District, Humboldt River Field Office	
Keysha Fontaine (Great Basin Institute, Contracted with the BLM)	Wildlife Biologist
Environmental Management and Planning Solutions, Inc. (EMPSi)	
Peter Gower	Project Manager (current), NEPA
Kevin Rice	Visual Resources
Jenna Jonker, Hanna Harper, Marcia Rickey	Geographic Information Systems
Morgan Trieger	Project Manager (previous), Vegetation, Migratory Birds, Wildlife and Key Habitat, Sensitive Species, Invasive, Nonnative Species, Wetlands and Riparian Areas, Visual Resources
Meredith Zaccherio, Morgan Trieger, Daniel Robison	Biological Survey Report
Andy Spellmeyer	Administrative Support
Sean Cottle	Planning and Administrative Support

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Appendix A
Geothermal Lease Stipulations

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Appendix B

Greater-Sage Grouse Required Design Features

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Appendix C

Bird and Bat Conservation Strategy

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Appendix D

Biological Survey Reports

EMPSi 2016; WRC 2013; ESRS 2013

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Appendix E

KOP Locations, Visual Contrast Rating Worksheets, and Photo Logs

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Appendix F

PEIS for Geothermal Resources Leasing in the Western United States—Appendix D: Best Management Practices and Mitigation Measures

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Appendix G

Response to Comments on the Revised Dixie Meadows Geothermal Utilization EA

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Appendix H

Aquatic Resources Monitoring and Mitigation Plan

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Appendix I

Utilization Plan and Plan of Development

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Appendix J

Environmental Protection Measures, Mitigation Measures, and Contingency Plans

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Appendix K

Memorandum of Agreement for Resolution of Adverse Effects

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Appendix L
Summary of Exploration Activity (2011–Present)

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Appendix M

Flow and Injection Testing Summary

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Appendix N
Limited Glossary

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