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

Environmental Assessment

New York Canyon Geothermal Utilization and Interconnect Project

June 2013

PREPARING OFFICE

U.S. Department of the Interior
Bureau of Land Management
Humboldt River FO
5100 East Winnemucca Boulevard
Winnemucca, NV 89445
775-623-1500

Environmental Assessment
New York Canyon Geothermal Utilization and Interconnect Project

DOI-BLM-NV-W010–2012–0005–EA

Prepared by
U.S. Department of the Interior
Bureau of Land Management
Winnemucca District Office, Humboldt River Field Office
Winnemucca, NV

June 2013
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Chapter 1. Introduction

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1.1. Identifying Information:

1.1.1. Title, EA number, and type of project:

New York Canyon Geothermal Utilization and Interconnect Project, EA number: DOI-BLM-NV-W010–2012–0005–EA

This is a project involving utilization of a geothermal fluid resources in/under existing federal geothermal leases and transmission in a newly proposed right-of-way.

1.1.2. Location of Proposed Action:

The Proposed Action is composed of a geothermal component and an electrical interconnection component located in Pershing county, Nevada, as shown in Figure 1, Project Location. The Proposed Action also includes an air-access flight path that extends into Churchill County.

The geothermal component of the proposed project includes the drilling of geothermal fluid production and injection wells on well pads previously permitted under the New York Canyon Geothermal Exploration EA (Exploration EA), the construction and operation of a power generation facility, access roads, geothermal pipelines, an airfield, and a groundwater production well and is proposed to be located in the Buena Vista Valley on the western slope of the Stillwater Range approximately 25 miles east-southeast of Lovelock, Nevada, in Pershing and Churchill Counties, Nevada. The electrical interconnection component of the proposed project includes the construction and operation of a 26-mile electrical transmission line, substation expansion, and would extend from the Oreana substation, approximately 5 miles northeast of Lovelock, to the proposed geothermal power plant in Buena Vista Valley, approximately 25 miles east of Lovelock.

1.1.3. Name and Location of Preparing Office:

Lead Office - Humboldt River Field Office, Winnemucca District Office (W010)

5100 East Winnemucca Boulevard, Winnemucca, Nevada 89445

1.1.4. Identify the subject function code, lease, serial, or case file number:

NVN-088828X

1.1.5. Applicant Name:

TGP Dixie Development Company, LLC (TGP)

1.2. Purpose and Need for Action:

The purpose of this action is to provide TGP the opportunity to construct and operate a geothermal power plant and infrastructure proximal to the Stillwater range, and install the necessary power line structures to connect the facility to the energy grid.

The need for action is established by the BLM's responsibility under the Geothermal Steam Act of 1970 and the implementing regulations provided under 43 Code of Federal Regulations (CFR) 3200. The need for action is also established by the BLM's responsibility under the Federal Land Policy and Management Act of 1976, and right-of-way (ROW) Procedures at 43 CFR 2800, to process a ROW application.

1.3. Scoping, Public Involvement and Issues:

A 30–day public scoping period was held ending February 10, 2012. Five scoping letters were received from the following parties:

- Nevada Department of Conservation and Natural Resources, Division of Water Resources
- US Environmental Protection Agency, Region IX
- US Fish and Wildlife Service, Pacific Southwest Region
- Churchill County, Office of County Manager
- Newmont Mining Corporation

As a result of the public and internal scoping process, the following issues of concern were identified, as outlined below in Table 1.1. The table also tells the reader where the comment is addressed in the EIS.

Table 1.1. Issues of Concern Identified in Project Scoping

Issue	Reference
What are the effects on wildlife and birds, biodiversity, and areas with sensitive resources such as unique plant community types, wetland and riparian habitats, wilderness areas, raptor nesting sites, and wildlife corridors?	Sections 4.1.4 Migratory Birds, 4.1.18 Special Status Species, 4.1.19 Vegetation, 4.1.23 Wildlife
What are the potential impacts on special status species, particularly with respect to nesting sites, hibernation sites, breeding and foraging areas?	Sections 4.1.18
Would the project affect public the public's ability to access through the project area?	Section 4.1.10
How will the introduction of invasive plants to the Project Area be minimized?	Section 4.1.3
What is the potential for catastrophic hazardous materials releases and how will they be prevented?	Section 4.1.7
What are the health and safety aspects of all hazardous materials used, particularly the working fluid?	Section 4.1.7
What are the effects on groundwater quality from any toxic effluents? What is the potential for a catastrophic event that may result in the release of such materials?	Section 4.1.8
What are the effects of geothermal drilling and geothermal production on shallow (non-geothermal) aquifers, nearby springs and any associated riparian and wetland habitats?	Sections 4.1.8, 4.1.9, 4.1.21
What are the potential effects of noise on wildlife and Native American Religious Concerns?	Sections 4.1.5
What would be the impact on dark skies from the project?	Section 4.1.20

Would the project result in habitat fragmentation, including fragmentation within grazing allotments and wild horse management areas?	Sections 4.1.22, 4.1.15
What would be the amount of greenhouse gas emissions associated with implementation of the project, both short-term and long-term, as well as emissions of Criteria Air Pollutants?	Section 4.1.1
What is the effect on cultural (archaeological and historical) resources?	Section 4.1.2
What is the effect on existing mineral rights?	Section 4.1.12
What is the effect on military training flights?	Section 4.1.20.1
What is the effect on Indian sacred sites?	Section 4.1.5

1.4. Background

In late 2008, TGP Dixie Development Company, LLC (TGP), through its wholly owned subsidiary Nevada Power Vestors, purchased five federal geothermal resource leases in the New York Canyon area from Caithness Energy. TGP then acquired three geothermal leases in the area from a 2009 Bureau of Land Management (BLM) lease sale, and an additional four leases from a 2010 lease sale. In December 2010, TGP acquired a final lease from Ormat. The thirteen geothermal leases held by TGP for the New York Canyon Lease Area (Lease Area) comprise 28,618 acres. The Lease Area is approximately 25 miles east-southeast of Lovelock, Nevada, in Pershing and Churchill Counties, Nevada (see Figure 1). TGP has gained understanding of the geothermal resource from the operation of its nearby existing Dixie Valley geothermal power plant and from previous exploration and development work performed in the New York Canyon and adjacent Dixie Valley areas by Caithness Energy, Oxbow Geothermal Corporation, Sun Geothermal Company, and Trans Pacific Geothermal.

TGP has conducted initial exploration activities on their geothermal leases, including geological mapping, gravity, magnetotelluric and seismic reflection surveys. In October 2010, the BLM Humboldt River Field Office (HRFO) completed an environmental assessment (EA) which resulted in a Finding of No Significant Impact and Decision Record for TGP's operation plan and drilling plan for the New York Canyon Geothermal Exploration Project. The exploration plan is for TGP to construct up to 15 well pads on up to 6 of the federal geothermal leases owned by BLM. Each of the 15 well pads was approved for full-size exploration wells. Total disturbance associated with these approved well pad locations and access was approximately 82 acres. As of early 2013, no drilling has been initiated. Right-of-way application N-88195 was approved by the HRFO on December 1, 2010 giving TGP authorization for the development of an access road and a pipeline in the length of 47,308.8 feet at a width of 25 feet, covering 27.15 acres, more or less, in T25N, R35E, sections 1-2, 10-11, and 15, et al. in the Project Area.

Based on the successful results of geophysical exploration activities, TGP has determined that the geothermal resource is capable of commercial production. As such, TGP is proposing the New York Canyon Geothermal Utilization and Interconnect (Project), which consists of one approximately 70-Megawatt (MW) gross, utility-grade geothermal power plant, up to 45 production and injection wells, pipelines, and a 230-kilovolt (kV) transmission line in Churchill and Pershing Counties, Nevada (Figure 1). The construction of associated access roads, well pads and exploration drilling activities were all described in TGPs operations plan for the New York Canyon Geothermal Exploration Project and previously approved by the BLM HRFO.

Figure 1. Project Location

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Chapter 2. Proposed Action and Alternatives

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Figure 2, Overview of Proposed Action and Alternative 1, provides an overview of the Proposed Action and Alternative 1, which are described in this section.

2.1. Proposed Action

TGP is proposing a geothermal development project which includes the conversion of geothermal exploration wells to geothermal fluid production and injection wells, the additional drilling of new geothermal production and injection wells on previously permitted well pads, the construction and operation of a 70 megawatt (gross) geothermal power plant, access roads, geothermal fluid pipelines, a 26-mile 230-kV generation tie line (gen-tie), an air strip and hangar, and support facilities.

The following three terms are used in this document to describe the geographic extent of the project:

- Lease Area – the 28,618 acres of federal geothermal leases held by TGP. The Lease Area is shown as a dotted blue line on Figure 2.
- Geothermal Development Area – the 7,800 acres of lands within the Lease Area that have been surveyed for cultural and biological resources and which may have disturbance. The Geothermal Development Area would contain the well-field, the power plant, the air strip and hangar and the associated access roads. The Geothermal Development Area is shown as brown polygons in Figure 2 and in Figure 3, Geothermal Development Area.
- Project Area – includes (1) the Geothermal Development Area, (2) the 200-foot gen-tie corridor that extends 26 miles for the Proposed Action or 24 miles for Alternative 1, and (3) 150 foot by 150 foot area for the expansion of the Oreana substation for the Proposed Action, or the 5 acre site on BLM-administered lands for a new substation under Alternative 1.

Table 2.1, Proposed Action Disturbed Areas, summarizes the proposed new facilities with estimated area of long-term (for the lifetime of the project) or temporary (during construction activities) disturbance for each component. Long-term disturbed areas would be reclaimed using a BLM-approved seed mixture at the end of plant life and gen-tie life. Temporarily disturbed areas would be similarly revegetated at end of construction activities so that any such area would remain devegetated for a period ranging from a few days to two years. The exact project lifetime is not known and would continue as long as the geothermal resource is capable of production and as long as there is a market for the energy produced. Power sales contracts are often for 20 to 30 years, but can be renegotiated or a new contract obtained. A well-managed resource can produce for many decades.

In early 2011, TGP submitted a Plan of Development to the HRFO for a ROW for the gen-tie. A Plan of Utilization was also submitted in early 2011 for the utilization facilities to be used for the project. Geothermal Drilling Permit applications would be submitted for downhole casing and cementing engineering for each well as the project progresses.

The submitted Plan of Development and Plan of Utilization are required for the BLM to approve those portions of the proposed project activities which are on public lands managed by the BLM. The project description as presented in this section is organized into the two major components of the Proposed Action: (1) the gen-tie, and (2) the well field and power plant.

Table 2.1. Proposed Action Disturbed Areas

Facility	Number Required	Area/Dimensions Per Structure	Long-Term[4] Disturbance Area (acres)	Additional Short-Term Disturbance Area (acres)	Previously Approved Disturbance (acres)
Gen-tie staging area	1	5 acres contained within 60 acre power plant site	0	0	0
Gen-tie support structures[1]	196 support structures	Up to 24 square feet per structure	<1	0	0
Gen-tie construction workspace	196 sites	Up to 220 by 60 feet and 30 by 40 feet	0	65	0
Gen-Tie Wire Setups	9 sites (one every 3 miles)	600 feet by 100 feet	0	12	0
Gen-tie Access Roads	26 miles (137,280 feet)	8 feet wide temporary 4 feet wide (2-track road) long-term	13	25	0
Airstrip	1	5,000 feet by 120 feet	14	0	0
Hangar, Parking, Access	1	250 feet by 200 feet	1	0	0
Power Plant and Ancillary Facilities	1	1,170 feet by 2,240 feet	60	0	0
Production Pipeline	17,640 feet	300 feet temporary width, 155 feet long-term	63	59	0
Injection Pipeline	25,123 feet	300 feet temporary width, 155 feet long-term	89	84	0
Pipeline Supports[2]	1,425 supports	Up to 0.70 square feet per structure	<1	0	
Power Plant Access Roads[3]	2.6 miles	25 feet wide	8	0	0
Gravel extraction	1 to 3	Disturbance spread across up to 3 locations	20	0	0
Well Pads	15	350 feet by 350 feet, plus one groundwater well pad of 150 feet by 150 feet	0	0	42
Well-Field Access and Branch Roads	N/A	48,035 feet by 25 feet wide, plus turnouts	0	0	40

Total Disturbed Area	268	245	82

1. Gen-tie support structures would be placed every 700 feet on average, for a total of approximately 196 structures along the expected maximum length of the Proposed Action Gen-Tie line. Up to 24 square feet of disturbance for a 3-pole structure, with up to 8 square feet of disturbance per pole.
2. 1,176 supports, spaced 30 feet apart, along 42,763 feet of pipeline.
3. Disturbance acreage using power plant location with the longest access road needed (southern location).
4. Long-term means for the lifetime of the power plant and generation tie-line. Short-term disturbance means for the duration of construction activities. Long-term disturbed areas would be reclaimed using a BLM-approved seed mixture at the end of plant life and gen-tie life. Short-term disturbed areas would be similarly revegetated at end of construction activities.

2.1.1. 230–kV Gen-Tie

As shown in Figure 2, TGP is proposing to construct, operate, and maintain an overhead 230-kV transmission interconnection line (gen-tie) originating at the proposed power plant site. The gen-tie, at 26 miles in length, would tie into the NV Energy power grid at the Oreana Substation near Lovelock, Nevada. Detailed maps of the gen-tie route are provided in Appendix A (*Appendices are available for download from the project website under "Documents"*).

The proposed gen-tie alignment is depicted in Figure 2. The gen-tie would consist of a single 230-kV circuit on H-Frame or three-pole wooden structures. Figure 4, 230-kV Wood H-Frame Structure, shows the typical H-frame wooden pole structure and Figure 5, Typical 3-Pole Structure, depicts a typical three-pole structure, both of which are proposed for use at New York Canyon. Structure heights would be up to 85 feet tall, and the span would be between 600 feet and 800 feet depending on the terrain. The gen-tie would consist of a single conductor per phase using 954-kcmil aluminum conductor and steel reinforced cable measuring 1.24 inches in diameter. This conductor is rated to carry 900 amperes (A) or 350 megavolt-amperes. The overhead conductors would be non-specular to reduce sunlight reflection and minimize impacts on visual resources.

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 fiber optic strands. Structures would meet Avian Power Line Interaction Committee guidelines. Metering and communications equipment would be required at each generator site.

A summary of the gen-tie specifications is provided in Table 2.2, Gen-Tie Specifications, and details for the route are presented below.

Table 2.2. Gen-tie Specifications

Feature	Specification
Line Length	26 miles
Type of Pole Structures	Wood pole structures; either H-frame or three-pole
Structure Height	80 feet to 85 feet
Span Length	Approximately 600 to 800 feet depending on terrain
Right-of-Way Width	Up to 200 feet
Voltage	230 kV
Circuit Configuration	230 kV, three phase, single conductor per phase

Conductor Size	954-kcmil aluminum conductor and steel reinforced, 1.716-inch diameter
Ground Clearance of Conductor	35 feet minimum
Structure Foundation Depth	7 to 14 feet depending on structure location, geology and structure type
Temporary Work Areas Required	A single 5 acre staging area that would be located within the power plant site and used for all other aspects of project construction as well; 0.33 acres for line construction equipment at each gen-tie structure site; 100 feet by 600 feet for tensioning equipment spaced every 2 to 4 miles

The easternmost portion of the route, traversing Antelope Valley, is located strictly on BLM-managed lands. From the edge of the Humboldt Range and for the remaining portion of the route toward the Oreana substation, land ownership along the route is largely in a checkerboard pattern, with approximately half of the lands being BLM-managed public lands, and the other half being privately owned.

2.1.1.1. Route Description

The gen-tie route would travel from the northwestern edge of the Lease Area northwest for approximately 9 miles (depending on the power plant site selected) across Antelope Valley, pass around the bottom end of the Humboldt Range, cross Packard Flat, cross between the West Humboldt Range to the south and the Humboldt Range to the north through Rochester Canyon, and terminate directly adjacent to the Oreana substation, approximately 2.25 miles east of Interstate 80 and 0.6 mile north of Lovelock-Unionville Road. Table 2.3, Coordinates of Proposed Action Gen-Tie Route, lists the coordinates of the Proposed Action Gen-Tie route.

Table 2.3. Coordinates of Proposed Action Gen-Tie Route

Angle Points	Latitude (°N)	Longitude (°W)
NYC Plant	40.067528	-118.003253
B PI 10	40.131519	-118.130656
B PI 20	40.156067	-118.174667
B PI 30	40.182411	-118.180883
B PI 40	40.188428	-118.187547
B PI 50	40.247308	-118.201487
B PI 60	40.264717	-118.231210
B PI 70	40.276813	-118.238751
B PI 80	40.291967	-118.252204
B PI 90	40.328955	-118.274583
Oreana Sub	40.335547	-118.274380

2.1.1.2. Grid Interconnection

The gen-tie route would deliver power to the NV Energy grid by connecting the proposed power plant electrical substation to an expansion unit connected to the existing Oreana substation located approximately 24 miles northwest of the proposed New York Canyon Geothermal Utilization and Interconnect. The new unit would convert the lower voltage carried by the gen-tie (230 kV) to a higher voltage carried by the 345-kV Tracy-to-Valmy transmission line. A steel dead-end structure within the substation would provide a termination point for the 230-kV gen-tie.

2.1.1.3. Existing Substation Tie-in

The Proposed Action would require the expansion of the Oreana substation at the interconnection point to the 345-kV Tracy-to-Valmy transmission line. There is a fenced area set aside for expansion that would accommodate the modification. This substation and surrounding lands are privately owned. The proposed switchyard would be a single electrical bay expansion of the existing Oreana substation. The expansion would be approximately 150 feet by 150 feet and would typically consist of:

- One 345 kV SF6 breaker, two primary disconnect switches, metering, and protective relaying;
- A 200 square-foot pre-fabricated control building containing relay and breaker control panels, transmission line protection panels, a DC battery system and charger, a DC distribution panel, an AC distribution system, a SCADA system and an HVAC system;
- A 20 kilowatt emergency propane-fueled generator;
- Voltage and current transformers;
- Surge arresters;
- Steel structures, bus-work, insulators and fittings;
- Communication and safety equipment;
- Switchyard pole lighting, security fencing and gates;
- Below grade grounding grid;
- A lightning protection system including lightning rods, static wires, masts, down conductors, sub-grade ground rods and conductors to protect equipment from lightning strikes; and
- Civil works including foundations, piers, road accesses, final grades and permanent rock surfacing.

None of the switchyard equipment contains oil or hazardous liquids in volumes requiring environmental containment basins.

Monthly monitoring and inspection of equipment is required and major equipment maintenance is expected approximately every five years for a duration of one to three days. Maintenance is typically performed by 3 to 5 electricians using light trucks, hoists or a small crane.

2.1.1.4. Communications

A Supervisory Control and Data Acquisition (SCADA) system would be required at the 345-kV substation and at the power plant substation. SCADA allows monitoring and control of electrical parameters such as current, voltage and power output. The system provides certain controls to remotely operated breakers and provides relay protective action in the event of electrical faults. Furthermore, SCADA provides monitoring and control of remote electrical substations associated with the interconnection of a remote power generation facility.

2.1.1.5. Land/ROW Requirements

2.1.1.5.1. Temporary Requirements

In order to accommodate construction activities, TGP would require a separate temporary 200-foot-wide ROW for the 230-kV gen-tie.

In order to accommodate construction equipment and activities, temporary work pads, which would be approximately 0.33 acres, would be necessary at each gen-tie structure site.

Stringing sites, which would each have an area of approximately 100 by 600 feet, would be necessary to install the conductor for the gen-ties. Stringing sites would generally be located approximately every 2 to 4 miles along the gen-tie routes.

One 5-acre staging area would be established within the selected 60-acre power plant site. The staging area would be established during construction to stage equipment and materials.

2.1.1.5.2. Long-Term Requirements

After construction is complete, TGP would require long-term ROWs for the gen-ties and access roads, and another ROW for newly constructed roads in order to conduct operations and maintenance activities. TGP would obtain a long-term right-of-way of between 60 and 125 feet wide (30 to 62.5 feet wide on either side of the centerline) to accommodate the swing of the conductor. The wider right-of-way would be needed for the 3-pole structures, for turning locations, and for areas that may be needed for future restringing as part of repair and maintenance.

2.1.1.6. Mobilization and Staging

A crew of up to 18 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 Geothermal Development Area. The staging area for power plant construction would be used for the temporary storage of equipment needed to construct the gen-tie. Water would be obtained from local water supply wells. TGP has submitted an application with the Nevada State Engineer to appropriate groundwater. See Section 2.2.5 Water Needs and Sources for more information.

2.1.1.7. Preconstruction Surveying and Staking

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 (if known), and wire setup sites. In addition, signs, flags, and fencing would be used to delineate project features such as access and sensitive resource areas.

Once the Project Area is staked, preconstruction plant and wildlife surveys, as required, would occur prior to beginning ground clearing. Coordination with a Nevada BLM-approved archaeological and paleontologist contractor will occur to avoid NRHP eligible cultural sites and important paleontological resources. Additional staking could be required just prior to construction to refresh previously installed stakes and flagging or to delineate any sensitive resource areas identified during the preconstruction field surveys.

2.1.1.8. ROW Preparation

In order to establish work areas where poles and conductors would be installed, vegetation clearing and grading within the ROW could be necessary. In all locations, vegetation removal would be minimized to the maximum 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 to achieve the necessary elevation.

No gravel is anticipated to be required under expected working conditions. Gravel would only be needed if construction were to occur in the springtime when conditions may be wet in ephemeral streambeds. To account for this possible scenario, it is assumed that up to 1,500 linear feet of gravel may be needed at a depth of 6 inches and a travel way width of 12 feet. Gravel would be left in place to facilitate maintenance access. Gravel would be obtained from either a private source or from up to two nearby existing pits on BLM-managed lands. If the gravel is sourced from a BLM-managed source, TGP would enter into supply agreement with the BLM. See Section 2.2.6, Gravel Needs and Sources for more information.

Within the 200 foot temporary ROW, TGP would select an alignment for an the gen-tie construction and an underlying access road. The alignment would avoid rocky outcroppings, rough topography, recorded archaeological sites, and other resources. The temporary access road would be 12-feet wide and would be constructed along the length of the gen-tie route to allow for transport of gen-tie components and construction equipment from pole location to pole location. A permanent 2-track access road would remain along the length of the ROW and all remaining disturbance would be revegetated. For purposes of disturbance calculations, the 2-track road is assumed to result in 2 feet of permanent disturbance per track, for a total permanent disturbance width of 4 feet.

2.1.1.9. Structure Placement

Materials, such as gen-tie poles, insulators, hardware, and guy wire anchors, would be delivered from the power plant staging area to each gen-tie structure site. Assembly crews would attach insulators, travelers, and hardware to form a complete structural unit. H-frame structures would consist of two poles connected by an "X-brace," with a horizontal cross-arm member mounted above the brace to support the electrical gen-tie. Three-pole structures would consist of three poles supported by guy wires and soil anchors. Each structure would require a temporary workspace of up to 220 feet by 60 feet and a 30-foot by 40-foot area for line construction equipment. Erection crews would use a large, mobile crane to place the assembled structures directly into the ground or would install them in reinforced concrete foundations, 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 gravel, sand or soil, or with concrete. 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 marking would be used to indicate the presence of guy wires. The long-term area of disturbance would depend on whether H-frame or three-pole wooden structures are used. Each wooden pole of a structure typically requires approximately 6 to 8 square feet per pole. Otherwise, the remainder of the temporary ROW would be revegetated with a BLM-approved seed mixture.

2.1.1.10. Conductor Placement

The installation of conductors and shield wires requires the following four-step process:

1. Install crossing structures (where necessary)
2. Install sock line (wire pull ropes)
3. Pull conductors and shield wires
4. Sag and connect conductors and shield wires

Prior to installing the new, overhead 230-kV conductor, temporary wooden pole crossing structures would be installed at road crossings and other locations where the new conductor could come in contact with existing electrical and communication facilities or vehicular or pedestrian traffic in the event the line accidently falls during stringing operations. An auger would be used to excavate the holes where the crossing structures would be installed and a crane would lift the structures into place. No concrete foundations would be required to set the crossing structures.

The temporary crossing structures would be removed following the completion of conductor stringing operations and the holes would be backfilled with excavated soil. As an alternative to crossing structures, flaggers could be used to temporarily hold traffic for brief periods of time while the overhead line is installed at road crossings.

Travelers would be attached to the insulators prior to pole setting. The travelers allow the conductor to be pulled between poles until the entire line is ready to be clipped in and pulled up to the final tension position. Conductor-stringing operations would begin by pulling a sock line (a small cable used to pull the conductor) onto the travelers from pole to pole with an all-terrain vehicle using overland travel techniques. Once the sock line is installed, it would be attached to reels of conductor or shield wire at the wire setup sites and pulled through in the reverse direction back through the travelers.

During the pulling process, enough tension would be maintained to keep the wires above the ground, avoiding any damage to the conductors due to dragging. Pulling/tensioning equipment would be located approximately every 2 to 4 miles and would occupy a temporary 100-foot by 600-foot area. For purposes of disturbance calculations, it is assumed that these wire set-up sites would occur once every three miles. After the conductors and shield wires have been strung, they would be sagged to the proper tension and clipped into the insulators. Pulling of the conductors would be accomplished completely within the ROW by trucks capable of off-road travel. Grading or clearing of the surface would occur only when absolutely necessary for the safe access or for installing the conductors and would only occur within the proposed ROW. These pulling stations would each be used for only short periods of time during the final construction process and would be reclaimed as necessary upon project completion.

Transmission line poles, with the below ground portions treated with pentachlorophenol, would be transported to the staging areas via commercial trucks. Pentachlorophenol is a biocidal agent and prevents the degradation of the underground portion of the utility poles from plant roots, insects, or fungi. Pentachlorophenol treatment is done at the lumber yard where the poles are prepared and extends average utility pole lifespan from 7 years (untreated) to 35 years (treated). Once at the staging areas, the poles would be transported to individual installation sites via flatbed trucks designed for overland travel. A standard truck-mounted auger and backhoe would be used

to drill the holes for pole installation. The poles would be lifted by crane and installed with the assistance of a boom truck. The construction of each tower would result in the temporary disturbance (crushed vegetation, etc.) of approximately 0.33 acres.

2.1.1.11. Site Cleanup and Demobilization

Surplus materials, equipment, and construction debris would be removed at the completion of construction activities. All man-made construction debris would be removed and disposed of appropriately at permitted landfill sites. Cleared vegetation would be shredded and distributed over the ROW as mulch and erosion control or disposed of offsite, depending on agency agreements. Rocks removed during foundation excavation would be redistributed over the ROW to resemble adjacent site conditions.

2.1.1.12. Restoration and Reclamation

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 and as applicable. Additionally, all other areas disturbed by construction activities would have gravel removed (if used) and then be recontoured, decompacted, and seeded. TGP would attempt to close or restrict vehicle access to areas that have been seeded until the reclamation success criteria have been achieved. Once construction is complete, the temporary right of way would be dissolved and replaced by a permanent right of way would of between 60 and 125 feet wide (30 to 62.5 feet wide on either side of the centerline) to accommodate the swing of the conductor.

2.1.1.13. Personnel

The construction workforce would consist of up to 18 personnel. Project construction also would require additional support personnel, including construction inspectors, surveyors, project managers, and environmental inspectors.

2.1.1.14. Equipment

Table2.4, Typical Gen-Tie Construction Equipment, presents a list of the typical equipment and their construction uses for a project of this nature. Not all equipment would necessarily be utilized during gen-tie construction. Only one piece of each type of equipment is expected to be needed.

Table 2.4. Typical Gen-Tie Construction Equipment

Equipment	Use
1-ton crew trucks	Transport construction personnel
2-ton flatbed trucks; flatbed boom trucks	Haul and unload materials
Rigging trucks	Haul tools and equipment
Mechanic truck	Service and repair equipment
Aerial bucket trucks	Access poles, string conductor, and other uses
Shop vans	Store tools
Bulldozers	Grade pole sites; reclamation
Truck-mounted diggers or backhoes	Excavate
Small mobile cranes (12 tons)	Load and unload materials
Large mobile cranes (75 tons)	Erect structures
Transport	Haul poles and equipment

Drill rigs with augers	Drill holes for pole structures
Pullers and tensioners	Pull conductor and wire
Cable reel trainers	Transport cable reels and feed cables into conduit
Semi tractor-trailers	Haul structures and equipment
Splice trailers	Store splicing supplies
Take-up trailers	Install conductor
Air compressor	Operate air tools
Air tampers	Compact soil around structure foundations
Concrete trucks	Pour concrete
Dump trucks	Haul excavated materials/import backfill
Fuel and equipment fluid trucks	Refuel and maintain vehicles
Water trucks	Suppress dust and fire
Winch trucks	Install and pull sock line and conductors into position

2.1.1.15. Schedule

Construction would take approximately 13 months to complete. Portions of the gen-tie line with seasonal restrictions due to environmental sensitivities would be prioritized to ensure sensitive timeframes are avoided. Construction would commence only after all required permits and authorizations have been secured.

2.1.1.16. Operations and Maintenance

Operations and maintenance personnel would conduct annual inspections of the gen-tie. Annual inspections would be conducted using helicopters, all-terrain vehicles, and/or line trucks. The inspections would involve a visual review of the gen-tie along a path that is roughly parallel to the centerline and along existing dirt access roads.

In addition to the annual inspections, TGP operations and maintenance personnel would conduct structure-climbing inspections every 10 years. These inspections would include accessing each gen-tie structure site using four-wheel drive vehicles on existing dirt access roads. At each structure site, TGP personnel would climb the structure to inspect the integrity and condition of the hardware and insulators. Maintenance would include gen-tie and pole repair and/or replacement, as deemed necessary.

TGP personnel would also require access to the gen-tie in the event of an emergency situation or if maintenance of a gen-tie structure is necessary. Under these circumstances, the gen-tie would be accessed by line trucks using existing dirt access roads and centerline travel routes or by helicopter.

2.1.2. Power Plant and Geothermal Well Field Development

The Geothermal Development Area is the portion of the Lease Area that has been surveyed for cultural and biological resources and that has the potential for on-the-ground disturbance as part of the development of the geothermal well-field, the power plant, the air strip and hangar and the associated access roads. The Geothermal Development Area comprises 7,800 acres.

As shown in Figure 3, TGP is proposing to develop a power plant on one of four candidate sites within the Geothermal Development Area. Also within this Geothermal Development Area, TGP is proposing to construct an airstrip and hangar, develop up to 45 wells for production, injection and monitoring, construct pipelines connecting these wells to the power plant, and develop

access roads. Aside from the candidate power plant locations and the airstrip and hangar, none of the other proposed project features are shown in Figure 3 because their locations would be determined based on the results of exploration activities. These features may occur anywhere within the Geothermal Development Area.

2.1.2.1. Production and Injection Wells

Fifteen exploration wells and well pads were analyzed under and approved based on the New York Canyon Exploration EA (DOI-BLM-NV-W010-2010-0004-EA) in 2010. TGP is proposing to convert all 15 proposed wells to either production, injection or observation wells via sundry notice, and to drill up to an additional 30 wells on those same well pads. It is anticipated, based on the productivity at wells at the nearby Dixie Valley power plant, that the Project would involve 9 production wells, 7 injection wells, with an additional 5 monitor wells for a total of 21 wells. However, to account for uncertainties in the geothermal resource, TGP is seeking approval of up to an additional 30 wells on the previously approved 15 well pads, for a potential total of 45 wells on 15 well pads. Those 15 well pads may be located anywhere within the Project Area as defined in the Exploration EA, avoiding any cultural or biological resources identified during those respective surveys. Geothermal Drilling Permit applications and/or a sundry notice would be submitted for approval prior to commencing the drilling of a well.

Storm water runoff from undisturbed areas around the constructed well site would be directed into ditches around the site and back onto undisturbed ground consistent with best management practices for storm water.

2.1.2.2. Geothermal Well Drilling and Testing

A detailed geothermal drilling program would be submitted to the BLM for review and approval prior to beginning drilling operations. This section summarizes the well drilling activities for purposes of evaluating potential environmental consequences. 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.

Each well would be drilled using a large diesel rotary drilling rig. During drilling, the top of the drill rig derrick would be up to 160 feet above the ground surface, depending on the rig used. The typical drill rig and associated support equipment (i.e., rig floor and stands; draw works; mast; drill pipes; trailers; mud, fuel, and water storage tanks; diesel generators; air compressors) would be brought to the previously permitted pad on seven to ten large tractor-trailer trucks. Additional equipment and supplies would be brought to the site during ongoing drilling and testing operations. An average of six to eight small trucks, service vehicles, and/or workers' vehicles could be driven to the active well site each day throughout the typical eight-week drilling process. Difficulties encountered during the drilling process, including the need to re-drill the hole, could increase the time required to successfully complete each geothermal well. Drilling would be conducted 24 hours per day, 7 days per week by a crew of up to 12 workers per well. Typically, one drill rig would be onsite at a time. However, TGP may choose to drill up to 3 wells at once, bringing the total crew to as many as 36. Crews would include the drilling supervisor, geologists, suppliers, and operators.

The drilling crew including drill supervisor, drilling rig manager (tool pusher), drilling mud engineer, well site geologist, and TGP company representative would typically sleep onsite during

drilling. As needed, a directional driller and well logger may also sleep on location. Each would be housed in recreational vehicle trailers located on the drill pad.

Each well would be drilled and completed to an approximate depth of 10,000 feet. The geothermal well drilling program involves a sequence of drilling a hole to a selected depth, cementing a steel casing of smaller diameter into the drilled hole, then repeating the process with progressively smaller holes and cemented casings to progressively greater depths until the design depth (or the depth selected in the field by the project geologist) is reached. The steel casing is designed to prevent mechanical failure of the drilled hole, prevent contamination of the ground water by the geothermal fluid, and prevent loss of the geothermal resource into other aquifers. After cementing of the initial ("surface") casing in the well, blowout prevention equipment (BOPE), which is typically inspected and approved by the BLM and/or the Division of Minerals of the Nevada Commission on Mineral Resources, as applicable, would be installed, tested and ready for use while drilling to ensure that any geothermal fluid encountered does not flow uncontrolled to the surface. Typical of most construction projects, the storage and use of these materials may result in minor, incidental spills of diesel fuel or oil to the ground during fueling of equipment, filling of fuel storage tanks, and handling lubricants. Other incidental spills could be associated with equipment failures such as ruptured hoses. The Project includes the development of a hazardous material spill and disposal contingency plan, as identified in the Utilization Plan, which describes the methods for cleanup and abatement of any petroleum hydrocarbon (including petroleum contaminated soils) or other hazardous material spill. Table 2.5 shows materials and chemicals commonly used during well drilling

Table 2.5. Materials and Chemicals Commonly Used During Well Drilling

Quantity Used	Quantity Stored	Product	Hazardous Material?[1]
200,000 lbs	100 lb sacks on pallets	Drilling Mud Gel (Bentonite Clay)	No
80,000 lbs	50 lb sacks on pallets	Salt (NaCl)	No
12,000 lbs	50 lb sacks on pallets	Barite (BaSO4)	No
2,500 lbs	50 lb sacks on pallets	Tannathin (Lignite)	No
2,000 lbs	50 lb sacks on pallets	Lime (Calcium Hydroxide)	Yes[2]
1,000 lbs	50 lb sacks on pallets	Caustic Soda (Sodium Hydroxide)	Yes[2]
30,000 gals	6,000 gal tank	Diesel Fuel	Yes[3]
1,000 gals	55 gal drums	Lubricants (Motor Oil, Compressor Oil)	Yes[3]
200 gals	55 gal drums	Hydraulic fluid	No
100 gals	55 gal drums	Anti-Freeze (Ethylene Glycol)	No[4]

100 gals	5 gal buckets	Liquid Polymer Emulsion (partially hydrolyzed polyacrylamide / polyacrylate (PHPA) copolymer)	No

1. Hazardous materials are defined and regulated in the United States primarily by laws and regulations administered by the U.S. Environmental Protection Agency (EPA), the U.S. Occupational Safety and Health Administration (OSHA), the U.S. Department of Transportation (DOT), and the U.S. Nuclear Regulatory Commission (NRC). Each has its own definition of a "hazardous material."
2. The material is characteristically hazardous due to its corrosivity
3. The material is characteristically hazardous due to its flammability
4. This material is considered orally toxic following ingestion.

Each well would be drilled to a depth of approximately 3,000 feet using non-toxic, temperature-stable drilling mud composed of a bentonite clay-water and/or polymer-water mix to lubricate and cool the drill bit, bring the rock cuttings to the surface for discharge into the reserve pit, and prevent loss of drilling fluids into the rock. Additional non-hazardous and non-toxic 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 drilling rig's mud system as needed to maintain the required quantities.

Below approximately 3,000 feet each well may be drilled using water with a soap/foam additive and compressed air to reduce the weight of the drilling fluids in the hole, maintain the reservoir permeability and carry the cuttings to the surface. The air, water, rock cuttings, and any reservoir fluids brought to the surface would be diverted through a separator/muffler to separate and discharge the air and water vapor to the atmosphere and the drilling mud and cuttings to the reserve pit.

Each well may need to be re-drilled if mechanical or other problems are encountered while drilling or setting casing which prevent proper completion of the well in the target geothermal reservoir. Depending on the circumstances encountered, re-drilling may consist of re-entering and re-drilling the existing well bore; re-entering the existing well bore and drilling a new well bore; or sliding the rig over to a new location on the same well pad and drilling a conductor and new well bore.

Upon completion of the drilling operations, clean-out and flow tests would be performed on the wells. Flow testing would typically run for an average of 3 days (24 hours a day) for each well, but the duration may vary depending on well characteristics. During these tests, the flow would be routed to the previously permitted reserve pits. As stated in the New York Canyon Exploration EA, each reserve pit would have up to 1 million gallons of capacity and the interior would measure approximately 320 feet long, 125 feet wide and a would be a maximum of6 feet deep below grade, including at least 2 feet of freeboard. The actual excavation depth for each reserve pit would be determined based on the depth to groundwater to ensure that the bottom of the reserve pit is above the standing water level. Reserve pits would be compacted during construction, and settled bentonite clay from drilling mud would accumulate on the bottom of the reserve pit to act as an unconsolidated clay liner to minimize percolation. A berm would be constructed around the outer edges of the reserve pit. The berm would measure approximately 4 feet wide by 2 feet tall. Material from reserve pit excavation would be used in the construction of the berm. The initial flow rates of fluid from each well into its reserve pit would be approximately 500 to 1,500 gallons per minute, on average, depending on the productivity of the well.

After completing and testing each well, it may be necessary to conduct well stimulation operations to enhance flow in the well bore, either from the well (production) or into the well (injection). Proposed well stimulation operations would involve well intervention performed on a geothermal well to increase production by improving the flow of geothermal fluids from the drainage area into the well bore. This kind of stimulation is in no way related to the term "stimulation" as used in the context of Enhanced Geothermal Systems (EGS). TGP does not proposed any EGS activities as part of this Proposed Action.

Proposed well stimulation operations could involve injecting diluted hydrochloric (muriatic) acid down the well; a 15 percent concentration would be typical. A 6 percent diluted hydrofluoric acid may be used in addition. The amount of dilute acid placed in the well bore could vary from 10,000 to 50,000 gallons or more based on well characteristics. Concentrated hydrochloric and/or hydrofluoric acid would be trucked to the site and diluted onsite with water. The diluted acid would be pumped down the well and then the well bore would be flushed with water to make sure the acid has exited the well into the geothermal resource formation. An acid clean-out of a well would involve pumping acid down the well bore to allow the acid to react with scale in the well bore. In both cases the acid would be neutralized as it reacts with the abundant carbonate and/or silica in the well scale or in the formation rocks. The well would then be flowed to a sump where the well fluid pH would be tested. Typically all acid has been neutralized by the time the well is flowed. The sump water would be chemically treated with an acid neutralizer such as soda ash or calcium carbonate if further neutralization is needed. Acids used in well treatments do not come into contact with ground water as the cement and casing strings protect the groundwater aquifers. Acid use would be approved by BLM, Nevada Division of Minerals and/or Nevada Division of Environmental Protection (NDEP). Acids for well stimulation would not typically be stored on site but would be brought in as needed. Well stimulations would be performed by a qualified contractor and trained crew, such as Halliburton or Baker Hughes. Acids would be stored in double walled tanks and/or in containment areas. Operators would be trained on handling of the acids and on spill containment. Spills of any chemicals or hydrocarbons would be promptly cleaned up, reported to NDEP and BLM when required and remediated.

Tracer dyes and radioactive tracers that have very short half-lives could be used during well stimulation. Non-hazardous fluorescent chemicals, such as fluorescein, would be used and are analyzed in this document. Tracer chemicals are used in minute portions and any used would have BLM, Nevada Division of Minerals and Nevada Department of Environmental Protection approval prior to use. TGP may conduct directional drilling at each site based on good well development practices and on the location and extent of geothermal resources in proximity to the well site. The bottom hole location of any directionally drilled wells would remain within the leased area, though may cross a lease line to another lease held by TGP. TGP Geothermal Drilling Permit applications would be submitted to the BLM for the drilling of these wells, pursuant to 43 CFR 3260.11.

A hydrological monitoring program has been developed to monitor potential effects on water resources on BLM-administered lands as a condition of approval in the 2010 New York Canyon Exploration FONSI and Decision Record (BLM 2010a). The plan was required to establish baseline data on water resources in the Project Area and to monitor the effect that geothermal development may or may not have on local water resources. The BLM-approved monitoring program includes, but is not limited to, monitoring groundwater quality, levels, and temperatures, as well as select springs in the nearby Stillwater Range. Monitoring activities would begin when exploration drilling begins. As drilling and development continue, data would be collected to establish hydrologic baseline characteristics and to refine the monitoring program. The hydrologic

monitoring program is currently designed to address the short-term presence of exploration activities. The hydrologic monitoring plan would be revised and approved by the BLM prior to initiation of any work on the wells related to utilization .

2.1.2.3. Geothermal Wells

The number of geothermal wells required for the Project is principally dependent on the productivity or injectivity of the wells and the temperature and pressure of the produced geothermal fluid.

Based upon the geothermal resource data collected to date, TGP expects that 9 geothermal production wells would be needed to produce the geothermal fluid required to support the Project. However, the productivity of the completed proposed wells, or the temperature and pressure of the produced geothermal fluid could be substantially lower than demonstrated by the drilling and testing conducted to date and could require the use of more than 20 wells. To ensure that sufficient wells are available to complete the project, TGP is proposing up to 45 wells (15 of the wells were previously permitted under the Exploration EA and an additional 30 wells are proposed as part of this project). The number of wells actually drilled would be divided between production and injection wells, plus some dedicated monitor wells. The results of well flow testing would determine which of these proposed production wells would be better used for the injection of geothermal fluid, or as monitor wells. Geothermal projects require monitor wells to assist in on-going well and reservoir evaluation and to meet federal, state and local requirements for geothermal reservoir and groundwater aquifer protection. The number of monitor wells required would be dependent on a number of factors, but an estimated range would be 5 to 10.

Geothermal injection wells would inject the geothermal fluid produced from the production wells back into the geothermal reservoir to maintain reservoir pressure and volume and ensure the sustainability of the geothermal resource. Geothermal fluid injection rates for either a binary, flash, or combined cycle power plant would range from 100 percent to 85 percent of the geothermal fluid production rates (16,500 to 19,400 acre-feet per year [AFY]), depending on whether and how much of any steam condensate evaporates from the cooling tower. Individual injection wells are expected to receive between 200 and 5,200 gallons per minute (gpm) (400 to 8,300 AFY) of geothermal fluid with wellhead injection pressures ranging from 30 to 75 pounds per square inch gauge.

Each of the production wells would either flow naturally to the surface, producing a mixture of liquid and steam, or be equipped with a pump to bring the geothermal fluid to the surface under pressure without flashing any of the geothermal fluid to steam. The electricity to power the well pump motors would be supplied via an electric conductor installed from the power plant along the connecting pipelines (see additional discussion below under "Geothermal Pipelines"). Wellhead dimensions for the pumped wells are not expected to exceed a height of fifteen feet above the ground surface or four feet in diameter. Wellhead dimensions for the wells not pumped (and the injection wells) would be much smaller. An approximately 8-foot by 15-foot by 10-foot high motor control building may be located within approximately 50 feet of each pumped well to house and protect the auxiliary well control systems; motor switch gear controls and sensors; transmitters for key temperature, pressure, and flow rate data; and geothermal fluid treatment systems. The well control systems, data transmitters and geothermal fluid treatment systems used for the wells which are not pumped (both production and injection) would typically be placed inside a smaller structure.

During normal well field operations, total geothermal fluid production rates would be expected to be approximately 12,000 gpm (19,400 AFY) at 320 degrees Fahrenheit, for either a binary, flash, or combined cycle type power plant. Individual production well flow rates are expected to be approximately 2,000 gpm (3,226 AFY) with a wellhead pressure of about 60 pounds per square inch gauge. Based on the results to date from other geothermal wells in the region, the produced geothermal fluid would be a neutral alkali-chloride type water typical of high temperature geothermal systems in the Great Basin. It would be rich in sodium (Na), potassium (K) and chloride (Cl), but relatively poor in calcium (Ca), magnesium (Mg) and bicarbonate (HCO3). The calculated total dissolved solids concentration would be about 2,000 parts per million.

The production of hot geothermal fluid from each well would be flow rate controlled. Pressure limit sensors would automatically shut down each well pump in the event of an excessively high discharge pressure, which could damage the pump. The well flow and any well head pumps would also be monitored by the power plant's computer control systems which would shut in the wells and shut down the pumps in the event of a mismatch in the geothermal fluid flow measured to and from the power plant (which could result from, for example, a leak in the pipeline).

Flow, temperature, and pressure would be continuously monitored. Well integrity would be tested every five years in accordance with Nevada Department of Environmental Protection, Bureau of Water Pollution Control (BWPC), Underground Injection Control Permit.

2.1.2.4. Geothermal Fluid Pipelines

Approximately 3.3 miles of geothermal fluid production pipelines would bring the geothermal fluid from the production wells to the power plant and approximately 4.8 miles of geothermal fluid injection pipelines would deliver the cooled geothermal fluid from the power plant to the injection wells. Disturbance acreages presented here assume that all 15 well pads would host wells that are useful for either production, injection or monitoring wells.

Production and injection pipeline routes would generally follow the shortest distance from each well pad to the next well pad or the power plant 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. The disturbance acreages provided above assume no overlap with road and provide a maximum potential disturbance scenario. Temporary disturbance would be up to 300 feet wide along the pipeline corridors, while the long-term pipeline corridor width would be 155 feet, composed of 100 feet wide to accommodate the expansion joints, 5 feet for pipeline, and 50 feet for road. A mock-up well pad and pipeline layout was developed that assumed all injection wells were placed in the southern polygon and that all of the production wells were placed in the northern portion of the Geothermal Development Area. This mockup allowed for estimated disturbance calculations and resulted in total long-term surface disturbance of up to 63 acres for production pipelines and 89 acres for injection pipelines. The additional disturbance that is temporary only would be 59 acres for production pipelines and 84 acres for injection pipelines. These acreages are reflected in Table 2.1, Proposed Action Disturbed Areas.

The geothermal fluid pipelines would be constructed from seamless, welded-steel pipe, and are expected to range in diameter from 8 inches to 24 inches. If any of the wells are naturally

produced, the geothermal steam and liquid produced in the well would either be conveyed to the power plant together in a single, larger diameter pipeline (up to 48 inches) or separated into steam and liquid at the well site and conveyed to the power plant in separate, parallel pipelines. Two to three inches of insulation and a protective aluminum sheath (appropriately colored to blend with the area) would jacket the steel production pipes, increasing the diameter of the finished production pipelines by up to 6 inches.

Horizontal expansion loops (a square bend in the pipeline approximately 30 feet in length by 30 feet in width) would be constructed about every 250 to 350 feet along the production pipelines in order to allow the pipeline to flex as it lengthens and shortens due to heating and cooling. Expansion loops along the injection pipelines would be less frequent, as they are subject to less heating and cooling. The pipelines would be constructed near ground level (averaging about one foot of ground clearance) on steel supports called "sleepers" constructed approximately every 30 feet, which support the pipeline. Electrical power and instrumentation cables for the well pump motors (if used), valves and instrumentation would either be installed in a steel conduit constructed along the same “pipe sleepers” or buried in a trench dug along the pipeline routes. (Pipe sleepers are used to allow the pipe to grow, and move on the pipe support stands, as a steel pipe expands when hot water flows through a cold pipe. Expansion loops are also included in pipeline design to allow for metal expansion.)

Pipeline construction would begin by vertically auguring approximately 24-inch diameter holes into the ground about eight to ten feet deep at approximately 30-foot intervals along the pipeline route (twin holes for two supports may be drilled at the pipeline anchor points, which would be located at the center of each expansion loop and in between each expansion loop). Dirt removed from the holes would be cast on the ground adjacent to each hole. The steel pipe "sleeper" would be placed in the hole and concrete poured to fill the hole slightly above the ground surface. The steel pipe sleeper would extend above the concrete, averaging approximately one foot above ground surface.

While the concrete is curing, the approximately 30-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 to blend with the area, following BLM visual resource management standards). When completed, the top of the new pipelines would average less than three 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 or buried in a trench dug along the pipeline route. If the trenching option for the power and control cables is selected, an approximately 12-inch wide trench would be excavated to an average depth of approximately three feet deep alongside the pipeline sleepers.

Pipeline road crossings would be constructed to allow continued vehicle access. This would typically use the cut-and-fill method, where a trench would be cut through the road, a prefabricated, "U"-shaped, oversized pipe sleeve (containing the fabricated geothermal fluid pipeline with the insulation and metal cladding in place) installed in the trench, the excavated dirt backfilled and compacted around and above the oversize pipe sleeve, and the roadbed material repaired or replaced. Alternatively, the pipelines could be constructed across the roads on sleepers (as described above) and the roadbed run up and over the pipeline. This would entail constructing a steel or concrete conduit over a pipeline where it crosses a road, then compacting dirt on either side of the conduit sufficient to ramp the roadbed up and over the conduit to allow

traffic to travel over the pipeline. The earthen ramp crossings would be marked with safety caution and speed limit signs.

Table 2.6, Typical Well Field Development Equipment, presents a list of the typical equipment and their construction uses for the well field development portion of the project. Not all equipment would necessarily be utilized. Only one piece of each type of equipment is expected to be needed.

Table 2.6. Typical Well-Field Development Equipment

Equipment	Use
Drill rigs	Drill wells
1-ton crew trucks	Transport construction personnel
2-ton flatbed trucks; flatbed boom trucks	Haul and unload materials
Rigging trucks	Haul tools and equipment
Mechanic trucks	Service and repair equipment
Shop vans	Store tools
Bulldozers and front end loaders	Grade pipeline mounts; reclamation
Truck-mounted diggers or backhoes	Excavate
Small mobile cranes (12 tons)	Load and unload materials
Transports	Haul pipelines and equipment
Semi tractor-trailers	Haul structures and equipment to Project Area
Air compressors	Operate air tools
Air tampers	Compact soil around pipeline foundations
Concrete trucks	Pour concrete
Dump trucks	Haul excavated materials/import backfill
Fuel and equipment fluid trucks	Refuel and maintain vehicles
Diesel-powered drill rigs	Drill geothermal wells
Diesel powered generators	Generate power the worker camp office and living quarters
Water trucks	Suppress dust and fire

2.1.2.5. Power Plant

TGP is proposing to construct, operate, maintain and eventually decommission a 70 MW (gross rated) geothermal power plant located on an approximately 60-acre site entirely on public land in one of the following locations, as depicted in Figure 6, Candidate Plant Locations and Access Roads:

- T25N, R35E, section 2 (Potential Location – South);
- T26N, R36E, section 30/31 (Potential Location – Central);
- T26N, R36E, section 29 (Potential Location – East); or
- T26N, R36E, section 30 (Potential Location – North).

Because the geothermal resource is not yet completely defined, the TGP power plant would utilize either a flash (steam) design or a binary (heat exchanger) design, or a combination of both designs. A binary technology power plant could require as little as 10 acres, whereas a flash power plant or combined cycle plant could require as much as 60 acres. The 60-acre estimation has been used for analysis. Photographs of these three plant types are provided in Figure 8, Example Power Plant Photos.

Limited roads would be required for vehicle access within the fenced, 60-acre plant site (Figure 7, Plant General Arrangement). Less than 2,500 feet of new access road would need to be constructed within the plant site to provide safe and efficient movement of maintenance vehicles. These access roads would generally be 25 feet wide or less. All roads within the plant site would be provided with a gravel cover to minimize the generation of dust and sediment. Roads within the plant site would be constructed in keeping with the BLM's Gold Book (BLM 2007) standards. A parking area approximately 100 feet long by 25 feet wide would be constructed outside the maintenance building, and a second parking area approximately 175 feet long by 25 feet wide would be constructed adjacent to the office building. A laydown area of approximately 400 feet by 600 feet would be constructed near the parking area to store equipment and materials prior to or during construction activities. The entire 60acre footprint of the plant site would be permanently disturbed by access roads, parking areas, and laydown areas.

The construction and operation of the proposed power plant would require several types of structures and ancillary equipment, including steam separators, power turbine(s), heat exchangers (binary and combined-cycle plants only), condensers and cooling equipment, and a 230-kV electrical substation. If needed, an additional communication line would be located on or near the existing transmission line within the existing ROW. Buildings required at the power plant include an office/control room and maintenance/storage buildings with associated parking areas. A gen-tie would be constructed at the site to interconnect the power plant with the existing 230-kV transmission line. Table 2.7, Power Plant Facility Structures, provides a summary of the facility structures, dimensions, and uses.

All power plant buildings (not including power plant equipment) would be rigid, steel-frame, pre-engineered structures with steel panel walls and steel roofs. The exterior of the buildings would be painted an appropriate color based on the BLM's standards to blend in with the surrounding environment.

Lighting at the power plant and production and injection wells would be designed in compliance with Federal Aviation Administration requirements and other applicable laws and regulations. Additionally, lighting would be designed to effectively reduce light pollution wherever possible. Where practical, lighting would be directional and would be hooded or shielded.

An 8-foot high chain link fence would be installed around the entire plant site to prevent unwarranted access to the facility by the public and to prevent wildlife from entering the facility/electrical generation area. The chain link fence would be equipped with controlled-entry gates to allow vehicle egress and ingress.

Table 2.7. Power Plant Facility Structures

Structure	Use
Office/Control Room	Office and restrooms
Electrical Room/Control Room Building	House switchgear, motor control center, control room
Electrical Substation	Voltage control and power distribution
Maintenance Building	Storage and maintenance of equipment/vehicles
Electrical Generator Facility(for use in Flash or combination technology)	Convert steam into electricity
Binary Power System (Heat Exchangers and Power Turbine)	Transfer heat from brine to working fluid and conversion of electricity
Air Cooled Condensers (Dry Cooling) or hybrid	Remove waste process heat from system
Brine Containment Basin	Collect excess flows from rock mufflers, cooling towers, stormwater, and equipment drains

Septic Disposal/Leaching Field	Dispose sanitary wastes generated in typical office/plant setting
Water Storage Tank	Store water for fire suppression
Fire Pump House	House fire control equipment
Lube Oil and Diesel Fuel Tank Secondary Containment Area	Store lube oil and diesel fuel
Non-Condensable Gas Removal System	Remove non-condensable gases from steam

2.1.2.5.1. Power Generation Technology

The proposed facility would utilize a flash, binary, or combined-cycle technology to produce electricity from the geothermal resource. The final technology selection would be determined by TGP based on final resource evaluation and construction costs. 8, Example Power Plant Photos shows sample photographs of these three kinds of power plants already in operation.

2.1.2.5.1.1. Flash Unit

Geothermal fluid received from the production wells would enter the plant and move through a series of high- and low-pressure separators where steam is separated from the geothermal fluid. The spent geothermal fluid (brine) is injected into the geothermal resource. The steam is sent to a steam turbine generator where the thermal energy in the steam is converted into mechanical energy by rotating the steam turbine rotor, which turns a generator to produce electrical energy.

The steam is then condensed back to a liquid state for reuse in the process and ultimately injected into the geothermal resource. The steam can also contain gases (referred to as non-condensable gases or NCGs) that would not condense (primarily carbon dioxide). These gases are removed from the system via a vacuum pump and vented to the atmosphere. A variety of gases would be entrained in the geothermal fluids produced from the production wells. The majority of these gases separate into the steam phase during the flashing operations. The largest constituent in the gas stream would be carbon dioxide, generally comprising greater than 95 percent of the total, with smaller amounts of other gases such as hydrogen sulfide, nitrogen, and methane. These gases would collect in the condenser and must be removed for proper operation of the condenser. Removed NCGs would be routed to the cooling system before being emitted to the atmosphere.

The cooling process used to condense the steam would be either a dry cooling system or a hybrid cooling system. The dry cooling system operates similar to an automobile radiator where steam from the steam turbine enters the cooling unit (or radiator) and a series of fans blow ambient air over the cooling unit (or radiator) to condense the steam. No water is used for process cooling and no particulates are emitted.

The hybrid cooling system uses a combination of water cooling and dry cooling technologies to accomplish the process cooling required. This hybrid cooling technology results in a significant reduction in water consumption over a traditional wet cooling system. If a hybrid cooling system is selected, the power plant would use up to 550 AFY of water for cooling purposes. Particulates suspended in the cooling water would be released to the atmosphere in a hybrid cooling system.

As required to initiate well/plant startup or when upset conditions occur, produced steam would be vented to an above-grade rock box, which is used to reduce the noise when the steam is vented off into the atmosphere, located adjacent to each plant site.

In a flash system, air emissions are generated when the steam used to power the steam turbine generator is condensed. In the condensing process, the steam is cooled to the point where it changes from a gas to a liquid. The steam contains NCGs that remain as gases. The NCGs collect in the condenser and require removal by a pump. The pump discharges the NCGs to the atmosphere via cooling fan shrouds, which disperse the gases into the air flowing upward and out of the cooling fans.

Based on data collected at the nearby Dixie Valley geothermal power plant that has been in operation for over 23 years, TGP anticipates that the geothermal steam to the plant would have approximately 2,500 parts per million by weight of NCGs, of which approximately 98 percent would be carbon dioxide and about 0.5 percent would be hydrogen sulfide. The other gases would consist primarily of nitrogen, ammonia, methane, hydrogen, and argon. Actual levels of NCGs would be determined once well testing has been completed.

Comparing steam chemistry analysis, Dixie Valley would have emitted some 31,000 tons carbon dioxide in the first year of operations (1988), dropping to 22,000 tons by 1991, and down to 16,000 tons by 1994. Within six years the NCG's, including carbon dioxide, had dropped by half. Degassing of the NCG's in the reservoir happened fairly quickly, providing evidence of recycling of the water and demonstrating that it is a renewable resource. A similar schedule of carbon dioxide emissions is expected for a New York Canyon power plant.

2.1.2.5.1.2. Binary Unit

The binary unit uses a secondary organic working fluid, such as pentane, isopentane, butane, isobutane, or a refrigerant such as R245fa, to extract heat from the geothermal fluid. The working fluid is vaporized, due to a lower boiling point, in a heat exchanger to drive special organic fluid turbines (similar to the flash unit described above). The working fluid is condensed in an air-cooled condenser. It then repeats the process as it is operated in a closed-loop system. The Organic Rankine Cycle technology would use the same quantity of geothermal fluid as the flash system. In a binary system, the geothermal would never flash to steam and therefore NCGs would not be released out of solution. The geothermal fluid would be injected back into the geothermal resource.

A binary cycle plant may use wet or dry cooling.

With dry cooling, there are no emissions.

Wet cooling would have emissions of water vapor from the cooling tower and emissions of particulates in the cooling tower drift. These emissions would continue throughout the power plant lifetime. Emissions of water vapor from cooling towers can form a vapor plume during times of high humidity when the water vapor is not readily absorbed into the atmosphere. In the climate of northern Nevada, this usually occurs in the colder months, when the air temperature drops and the air humidity increases. Cooling tower drift is a type of moisture release that results when small quantities of water droplets of 10 microns or greater and dissolved solids become airborne and are carried out with the exhaust air. Cooling tower drift is controlled and minimized through the use of drift eliminators.

2.1.2.5.1.3. Geothermal Combined Cycle

The geothermal combined cycle utilizes both flash and binary technologies combined in a single power plant. The steam and geothermal fluid that exits the flash unit's steam turbine generator would be directed to the binary unit (as described above) to generate additional electrical power. The combined cycle system would use the dry cooling technology to condense the steam for injection into the geothermal resource.

The combined cycle would produce the same amount of NCG as the flash system.

Binary cycle power plants can use either high or moderate temperature geothermal resources. Geothermal fluids for a binary power plant may be produced from the production wells either by natural flow (high temperature) or by pumping (moderate temperature). Flash power plants typically use higher temperature geothermal resources and can be more efficient for a high temperature resource. The geothermal fluid for a flash power plant is often naturally produced (without pumping) from the production wells.

Installed equipment and site appearance for a flash power plant would be similar to a binary power plant except that the separator vessels (geothermal fluid to steam and geothermal liquid) would be added and the binary working fluid storage tanks would be removed.

In a flash steam plant, the non-condensable gases (principally carbon dioxide, with some small amounts of nitrogen, methane, ammonia and hydrogen sulfide) contained in the geothermal steam would be removed from the steam condenser system and exhausted to the atmosphere through an exhaust stack and the cooling tower. Emissions would be regulated and monitored under a Class I or Class II Operating Permit issued by the Nevada Department of Environmental Protection, Bureau of Air Pollution Control (NDEP-BAPC) if required by NDEP and depending on the working fluid chosen.

If a binary plant were constructed, there would be no continual release of non-condensable gas emissions. However, there may be irregular and intermittent fugitive emissions to the atmosphere of vaporized working fluids from rotating seals and flanges and from the process to purge the buildup of air leaking into the binary turbine condenser. These binary working fluid emissions would also be regulated and monitored under a Class II (non-major) permit issued by the NDEP-BAPC.

2.1.3. Actions Proposed on Private Lands

Power plant and well field development would occur entirely on Federal lands with geothermal leases held by TGP. As shown in Figure 2, portions of the gen-tie line would occur on private lands. The gen-tie route would cross 7.6 miles of private land. TGP would contact private land owners to arrange for access.

2.1.4. Site Access

Typical land-based access to the New York Canyon Project Area would be from Lovelock, Nevada, along route 857 (East Coal Canyon Road, which becomes Fencemaker Flat Road near the Geothermal Development Area) up to the Lease Area. The proposed air strip would also provide access to the Lease Area by airplane. Flight paths are shown in 1. The primary flight path that would be used on most occasions would involve flying north-northeast out of the Fallon

Municipal Airport, would turn to the northeast just past Trinity Junction, and then would turn southeast at the southern edge of the Humboldt Range before arriving at the proposed airstrip. This flight path would avoid Navy airspace. On occasion, during times when the US Navy is restricting airspace along the primary flight path, TGP would use an alternative flight path that would start to the northeast out of Fallon, would cross the southern portion of the Stillwater Range into Dixie Valley, would then veer north-northeast above the eastern slopes of the Stillwater Range, and once meeting the Lease Area would veer northwest to the airstrip. The same paths would be used for return flights to Fallon. The final flight path would need to be approved by the Federal Aviation Administration.

Existing and already approved access roads would be sufficient for well drilling and testing activities. For power plant construction and operation, both primary and secondary access roads would need to be constructed on the selected power plant location. The length and location of these roads would depend on the location of the power plant. Primary access roads would be used for daily access needs, whereas secondary roads are required for emergency access, particular to allow options for ingress and egress in case of wildfire or fire at the power plant.

Existing mining roads would be sufficient for secondary, emergency-use roads, while primary access roads would require an all-weather surface with a road bed width of 16 feet, a maximum grade of six percent and a turning radius of no less than 50 feet, consistent with the best management practices for road construction applicable to development roads.

Temporary 12-foot wide and permanent 2-track roads would be required along nearly the entire 26-mile length of the gen-tie route. The proposed gen-tie routes parallel existing roads in some places. In these cases a new 2-track road would not be needed. The exact layout of access routes would be developed after completion of the National Environmental Policy Act (NEPA) process, and so for the purposes of this analysis, it is assumed that new access routes would be developed along the entire length of the proposed ROWs. The temporary 12-foot wide gen-tie access route would result in a long-term disturbance of 13 acres and an additional temporary disturbance of 25 acres. These access roads would be needed to move workers, vehicles, and equipment to the transmission line corridor during initial construction, and during inspection, maintenance, and repair of poles, insulators, and conductors.

Access roads would be maintained during construction and dust would be controlled using water. Any roads required for continued transmission line operations and maintenance would be stabilized and use of overland roads would be monitored to avoid rutting. Those roads not needed for transmission line maintenance, or public or administrative access would be reclaimed by removing any gravel, recontouring, scarifying, reseeding, and barricading.

All roads used to access the wells would be maintained as needed to safely accommodate the traffic required to drill and test the wells. Roads would be maintained consistent with guidance in the Gold Book. Drainage structures, which may be necessary to ensure proper and adequate road drainage (such as dips, ditches, road crowning and culverts), would be installed consistent with guidance in the Gold Book.

Table 2.8, Typical Power Plant Construction Equipment, presents a list of the typical equipment and their construction uses for the well field development portion of the project. Not all equipment would necessarily be utilized. Only one piece of each type of equipment is expected to be needed.

Table 2.8. Typical Power Plant Construction Equipment

Equipment	Use
1-ton crew trucks	Transport construction personnel
2-ton flatbed trucks; flatbed boom trucks	Haul and unload materials
Rigging trucks	Haul tools and equipment
Mechanic truck	Service and repair equipment
Shop vans	Store tools
Bulldozers	Grade pipeline mounts; reclamation
Truck-mounted diggers or backhoes	Excavate
Small mobile cranes (12 tons)	Load and unload materials
Transport	Haul pipelines and equipment
Semi tractor-trailers	Haul structures and equipment
Air compressor	Operate air tools
Air tampers	Compact soil around pipeline foundations
Concrete trucks	Pour concrete
Dump trucks	Haul excavated materials/import backfill
Fuel and equipment fluid trucks	Refuel and maintain vehicles
Diesel powered generators	Generate power for the worker camp office and living quarters
Water trucks	Suppress dust and fire

2.1.5. Water Needs and Sources

2.1.5.1. Construction Water Requirements

TGP would need water for well drilling, dust control and soil compaction during construction of the power plant site, well field facilities, access roads and parking areas around the plant site, and aboveground pipelines. Water would be obtained from local wells. TGP would secure water rights, either through new appropriations, or through entering into long-term water supply agreements with local ranchers who already have water rights.

TGP entered into a water use agreement with local rancher and water rights holder Jim Estill for water needs during the exploration phase of the New York Canyon project. This well is indicated on US Geological Survey topographic maps as “Buena Vista Well” and, as shown in Figure 3, is located immediately adjacent to and on the east side of Fas-615 and approximately 300 feet north of the Lease Area in the SE ¼ of the SE ¼ of section 19 of T26N R36E. Water from this well would be used for the construction phase of the project. Water would be transported throughout the construction area by a flexible, moving pipeline that would be resituated as construction progresses from area to area within the Geothermal Development Area. Over the twenty seven month construction period, TGP estimates that 20 million gallons of water would be needed for well drilling and all construction activities.

Bulk bottled water would be provided to construction personnel for drinking water throughout the construction period. Portable toilets would be provided during drilling and construction and would be periodically serviced by a commercial service provider.

2.1.5.2. Operational Water Requirements

On-going water use during the operational phase of the project would be under a new well to be drilled in the Lease Area under Nevada Division of Water Resources permit 81717 or from

cooling tower blowdown after the plant has been constructed. In April 2012, TGP submitted an Application to Appropriate to the Nevada Division of Water Resources for a water right of up to 550 acre-feet per year to provide groundwater for various plant uses. As shown in Figure 3, the proposed well would be located in the NE ¼ of the NE ¼ of Section 25 of 26N 35E.

2.1.5.2.1. Binary Power Plant

Process water needs include water for the fire pump system, general maintenance water, water for the domestic water system (up to 50 AFY in aggregate) and water for operation of the hybrid-cooling system (up to 500 AFY). Drinking water for on-site personnel would be provided from bottled water. Water for the domestic water system (emergency showers, eye wash stations, toilets, etc.) would undergo basic treatment with chlorination as needed to prevent bacterial growth but it would not be treated to meet drinking water quality standards. Water may also be used for reservoir augmentation. Over a theoretical 30 year lifespan of the power plant, 16,500 acre feet could be permanently withdrawn from the shallow aquifer.

2.1.5.2.2. Flash Power Plant

If TGP selects a flash technology plant, process and domestic water system needs would be 50 AFY if dry cooling is selected and up to 550 AFY if hybrid cooling is selected. Over a theoretical 30 year lifespan of the power plant, 16,500 acre feet could be permanently withdrawn from the shallow aquifer.

In addition, a flash technology plant would consume water from the geothermal reservoir through evaporative losses. Eight-five to 100 percent of flashed fluids would be cooled and recondensed for injection back into the geothermal reservoir. This leaves up to 15 percent of fluids that could be lost to evaporation from the cooling tower. At an annual flow of 19,400 acre-feet and a maximum evaporation factor of 15 percent, up to 2,910 acre feet could be lost to evaporation per year from the geothermal reservoir. Over a theoretical 30 year lifespan of the power plant, 87,300 acre feet could be permanently withdrawn from the geothermal reservoir from evaporation alone. Prior to consuming (allowing to evaporate) any such waters, TGP would need to acquire water right from the State of Nevada.

In total, a flash plant could consume 103,800 acre feet of water over a 30 year power plant lifespan.

2.1.5.2.3. Combined Plant

If TGP selects a combined technology plant, the consumption of geothermal water would be as described above for a flash technology plant, with total water consumption over a 30-year lifespan being up to 103,800 acre feet.

2.1.6. Gravel Needs and Sources

Gravel would be needed to surface access roads and other heavy use areas such as parking areas, areas under the cooling towers, and as base for the air strip and air hangar. Table 2.9 Proposed Action Gravel Requirements, summarizes the maximum potential gravel needs for the Proposed Action. Calculations assume the construction of access roads to the southern potential power plant site since that site would require the longest access road. To take into account the

possibility of an underestimation, TGP proposes the use of up to 50,000 cubic yards of gravel for the Proposed Action.

Table 2.9. Proposed Action Gravel Requirements

	Length (feet)	Width (feet)	Depth (feet)	Total Aggregate (cubic yards)
Airstrip	5,000	100	0.66	12,222
Hangar, Parking, Access	250	200	0.5	926
Power Plant Area – high traffic	2,000	300	0.66	14,667
Power Plant Area – low traffic	1,170	700	0.2	6,067
Gen-Tie Access Roads	1,500	12	0.5	334
Power Plant Access Roads	13,728	18	0.5	4,576
Total Aggregate Required:				**38,792**

To extract 50,000 cubic yards of gravel, it is estimated that up to 20 acres of disturbance would be required. TGP has identified the following three possible sources of gravel for the proposed project:

1. Three existing aggregate pits located within the boundaries of lease N86893 in T26N, R36E, section 21 These three pits would be accessed by Kitten Springs Road, to which they are directly adjacent. If TGP chooses to purchase material from this location, the material site would be designated as a community pit. The specific pit dimensions would be determined through coordination with BLM at that time. The average driving distance from the pits to the Geothermal Development Area is 5 miles.

2. An existing aggregate pit (Fencemaker Pit) in the northwest quarter of T26N, R36E, section 14. This aggregate pit would be accessed by driving 3.3 miles northeast along road "Fas-615" from the intersection with Kitten Springs Road, and then turning to the southeast along an unnamed road for 2 miles. The pit is then located 0.2 miles to the east along an existing unnamed road. In December 2012, the BLM Winnemucca District released a Decision Record for the Pershing County Road Department Free Use Permit Renewals, Expansions, and Community Pit Designations EA (DOI-BLM-NV-W010-2013-0012-EA). The Decision Record authorized the existing 5 acre pit to be expanded by up to 35 acres. The 20 acres of needed maximum disturbance for the proposed New York Canyon project would be covered under the NEPA analysis for the 35 acre expansion. This EA will address additional impacts related to the air quality and traffic associated with gravel extraction at this site. The average driving distance from the Fencemaker Pit to the Geothermal Development Area is 9 miles.

3. Purchase from Pershing Sand and Gravel Company in Lovelock. This option would be more likely for gravel needs along the portions of the gen-tie line closer to the Oreana Substation.

The maximum of 20 acres of disturbance could occur all in one of these three locations, or it could be split across 2 or 3 of these sources.

Sand and gravel would be loosened from the pits using bulldozers to push down the highwall slopes into the developing pit bottom where loaders would fill haul trucks or load the material

directly onto an in-pit conveyor system. No blasting would be required for mining of the deposits. Slopes would be re-contoured as needed to minimize collapse. Loaded material would be transported to an "in-pit" crushing/screening facility. If possible, this facility would be located below grade after the pit is established to reduce local noise levels and aesthetic impacts from the fugitive dust. Water trucks would fill up from the Proposed Action's water supply and would be used for dust abatement. The amount of water would minimal since it would only be needed for dust abatement. The mineral material would be crushed, sorted, washed and stockpiled. Front end loaders or backhoes may be used to load stockpiled product into dump trucks, which would haul the materials off the property and to the Project Area by way of existing access roads.

Gravel would be delivered to the Geothermal Development Area and the portions of the gen-tie route needing stabilization or smoothing to allow for access. It is estimated that up to 1,500 linear feet of the gen-tie route may need such gravel treatments. Gravel would be delivered to such areas by dump truck and then smoothed out using truck-mounted diggers, rakes or backhoes.

Delivery would be by belly dump trucks with a capacity of 20 cubic yards each, requiring up to 2,500 delivery trips. All gravel extraction and delivery is expected to be completed within the first 6 months of construction, for an average of 14 daily truck trips during this period.

The proposed gravel extraction sites would be designated as community pits (if not designated already) that would likely receive continued use after completion of construction of the Proposed Action. BLM would collect a reclamation fee for any sales from the community pits, which would be used to complete reclamation activities. No reclamation would be required of TGP for material that is purchased through private, commercial sources.

2.1.7. Project Construction Schedule

TGP anticipates construction would take approximately 24 months until the power plant facility would be operational. TGP would need to test facility equipment and operations for approximately three months prior to commencing commercial operations.

2.1.8. Site Preparation and Mobilization Activities

Site preparation and mobilization activities would include setup of temporary onsite lodging and transport and staging of equipment required for construction to a staging area in the power plant area. Onsite lodging would be used to supplement lodging in nearby communities; however, construction workers would stay in surrounding areas as much as possible.

A worker camp at the plant site would be needed both during construction and for occasional use during operations. The camp would have four self-contained trailers (estimated size up to 12 by 60 feet) used for offices and lodging. The trailers may include kitchen, dining area and showers and house up to three individuals each. The camp components would be transported to the site by trailer along the existing access road and proposed access roads. Portable water tanks would supply water for sanitary use, and drinking water would be bottled water. Sanitary storage tanks would be provided as part of the modules and would be periodically serviced by a commercial entity. Electricity would be provided by portable generators or by the plant after operations begin. Due to the remote location, one or two trailers may remain at the worker camp for use such as during storms or plant upsets.

It is estimated that up to 150 workers would be involved during the 24-month construction of the power plant, production and injection wells, pipelines, access roads and gen-tie, with the onsite workforce ranging between 80 and 100 during the initial 12 months; peaking at about 150 from month 13 to month 18; and gradually reducing during the last 6 months of construction. Operation of the power plant following construction would require a permanent workforce of up to 16 professionals in addition to regular maintenance activities supported by outside contractors.

Table 2.10, Estimated Workforce for Construction and Operation, details the total number of onsite personnel that are estimated to be required during construction and operation of the facility. More details on workers involved in individual aspects of the project are provided below.

Table 2.10. Estimated Workforce for Construction and Operation

Project Phase	Onsite Workforce Requirements	Indirect/Induced Jobs	Duration of Jobs (months)
Permitting	0	4	18
Power Plant Equipment Manufacturing	0	60	18
Construction	150	60	24
Operation and Maintenance	16	15	360
Total Jobs Created	**166**	**139**	

TGP has also provided an estimate of indirect and/or induced jobs that could result from the construction of the facility, including permitting professionals, jobs created or maintained from manufacturing of facility building components and equipment and jobs created offsite during construction activities based on established data provided by the Geothermal Energy Association (Kagel 2006).

As discussed in Section 2.2.2.2, TGP may choose to drill up to 3 wells at once, which at 12 people per drilling crew, the drilling work crew could be as many as 36.

Construction of the well field pipelines would require 35 workers over a period of approximately 9 months. Pipelines would be constructed after the wells are drilled and before the power plant begins operation.

Gen-tie construction would be conducted by up to 18 workers.

During operations, it is anticipated that up to 12 of the projected 16 employees would require daily air transportation from Fallon using TGP's contracted Bonanza A36. TGP already runs between two and six flights per day between Fallon and the existing Dixie Valley power plant. Stopovers would be arranged for drop off and pick up from the proposed New York Canyon power plant site. The proposed project would piggyback on the existing flights schedule of six flights per day Monday through Thursday and two flights per day Friday through Sunday. It is anticipated that the remaining up to four personnel would commute by personal vehicle from Lovelock.

2.1.9. Waste and Hazardous Materials Management

Secondary containment structures would be provided for all chemical and petroleum/oil storage areas during drilling and construction operations. Additionally, absorbent pads or sheets would be placed under likely spill sources and spill kits would be maintained onsite during construction and drilling activities to provide prompt response to accidental leaks or spills of chemicals and petroleum products.

Solid wastes generated by the Proposed Action would be stored onsite until transported offsite to an appropriate landfill facility in accordance with BLM and Pershing County regulations and all federal, state, and local regulations. A septic system would be installed in accordance with BLM and Nevada Division of Environmental Protection (NDEP) regulations and requirements.

A project hazardous material spill and disposal contingency plan would describe the methods for cleanup and abatement of any petroleum hydrocarbon or other hazardous material spill. The hazardous material spill and disposal contingency plan would be submitted to and approved by the BLM and made readily available onsite before operations begin.

Handling, storage, and disposal of hazardous materials, hazardous wastes, and solid wastes would be conducted in conformance with federal and state regulations to prevent soil, groundwater, or surface water contamination and associated adverse effects on the environment or worker health and safety.

2.1.10. Project Decommissioning and Site Reclamation

The estimated life of the Project is 30 years or its useful life, whichever is longer. At the end of Project operations the wells would be plugged and abandoned as required by BLM regulations. All above-ground equipment, including the power plant and ancillary facilities and the pipelines and their supports, would be removed.

Interim reclamation activities would be implemented as described below. TGP would reassess the usefulness of wells annually, and if TGP were to judge certain observation wells to be unsuitable for commercial use or monitoring, they would be plugged and abandoned in conformance with the procedures for final reclamation outlined below. Interim and final reclamation activities proposed in this section are consistent with BLM and Nevada Division of Minerals requirements, including recommendations provided in the BLM Gold Book (pages 4347; BLM 2007).

2.1.10.1. Interim Reclamation

During the construction process, topsoil would be salvaged where possible and stockpiled for use during reclamation. TGP would maintain healthy, biologically active topsoil and minimize habitat, visual, and forage loss during the life of the wells, power plant, pipelines and gen-tie lines by stockpiling and/or spreading any extra salvageable topsoil over the area of interim reclamation whenever possible. Following completion of observation well flow testing, drilling and testing equipment would be removed from the site. To maintain the full extent of the constructed area while still minimizing visual impacts, until the final reclamation stage could be determined, TGP would spread a minimum of 6 to 8 inches of stockpiled topsoil over the constructed well pad recontoured to an intermediate contour that blends with the surrounding topography. The area would be successfully revegetated to within a few feet of the area required to access and maintain the wellhead. Seeding would be implemented in the fall, October through December.

Surface facilities remaining on site for observation wells would consist of a wellhead and potential monitoring equipment, which would have a matte finish and be painted colors to blend with the natural surroundings per BLM visual resource management standards. Following completion of testing activities, the well would be fenced, chained, and locked. Wells could be shut-in with a mineral oil cap as applicable. Pressure and temperature sensors could be installed in the well at fixed depths to monitor any changes in these parameters over time. The observation well pads, access roads and reserve basins would be kept in their original position and be subject

to regular inspection and maintenance by TGP personnel, until the well is deemed by TGP to be unnecessary, at which time it would be plugged and abandoned, or the geothermal lease is relinquished back to BLM. Final reclamation activities for those sites would then be engaged.

2.1.10.2. Final Reclamation

Final reclamation would consist of three steps: power plant and well reclamation, gen-tie reclamation and road reclamation. For all three steps, TGP would either remove the gravel that had been applied during project construction or leave it in place, per BLM direction at that time and depending on potential future needs for roads in the area. The gravel may be of benefit to prevent erosion in certain areas. The reclaimed gravel may be brought back to the gravel pit or used for other purposes.

2.1.10.2.1. Power Plant and Well Reclamation

After well operations have ceased or the geothermal lease is released back to BLM, TGP would reclaim the Project Area by implementing surface reclamation measures and plugging and abandoning the wells in compliance with BLM and Nevada Division of Minerals regulations and requirements, including recommendations provided in the Gold Book (pages 43-47; BLM 2007). A detailed plan for well plugging and abandonment would be addressed in TGP's Application to Drill (Form 3260-3) and Drilling Program. Rolling dips would be removed. The power plant as well as project related equipment and machinery would be decommissioned and, where possible, reused or sold as salvage. Equipment with no resale value would be sold or given as scrap.

The area would be recontoured to blend with the surrounding topography. TGP would resurface well pads, including reserve pits and residual solids, with stockpiled topsoil where available, and reseed with a mix specified by BLM and free of noxious weeds at the time of reclamation. Topsoil would be respread evenly over the surfaces of the disturbed areas, and erosion-control measures and measures to control invasive non-native plants and noxious weeds would be implemented in accordance with appropriate BLM guidelines. Gravel depth measuring in excess of 8 to 10 inches would be reduced or removed from constructed well pads. The remaining gravel would be topsoiled, ripped and seeded and/or the gravel would be buried deep in the recontoured cut to prevent excess surface exposure. Reserve pits and central sump would be backfilled after they are dry and free of waste and graded to conform to the surrounding terrain.

2.1.10.2.2. Road Reclamation

. Following completion of project activities, access roads would be reclaimed by removing gravel, recontouring, reseeding, and controlling noxious weeds, unless the BLM requests that the roads remain intact. Project-related equipment and machinery would be decommissioned and, where possible, reused or sold as salvage. Equipment with no resale value would be sold or given as scrap.

TGP would restore the area to the original landform or, if restoration of the original landform is not feasible, recontour to blend in with the surrounding landform. Disturbed areas would be reseeded with a mix specified by BLM at the time of reclamation, and erosion-control measures and measures to control invasive non-native plants and noxious weeds would be implemented in accordance with appropriate BLM guidelines. Other techniques to improve reclamation success could be implemented at BLM's direction.

2.1.10.2.3. Gen-Tie Reclamation

. Poles, conductors, and hardware associated with the 230-kV transmission line 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 the appropriate seed mix (see Table 2.11, Proposed Seed Mix).

2.1.11. Environmental Protection Measures

TGP would comply with the special lease stipulations attached to federal geothermal leases (see Appendix B; *Appendices are available for download from the project website under "Documents"*).

A Worker Environmental Awareness Training program would be established that includes a daily overview of all environmental resources to be aware of, avoided, protected, or reported if found.

In addition, TGP proposes to implement the following environmental protection measures:

2.1.11.1. Cultural Resources

- TGP would avoid any disturbance within 30 feet of cairns (rock piles) within the Lease Area. TGP would stake-and-flag a 30-foot radius around the cairns and provide avoidance instructions to all on-site personnel and contractors.
- TGP would avoid ground disturbance of all National Register of Historic Places-eligible archaeological sites.

2.1.11.2. Palentological Resources

- Subsurface disturbance would not occur in stock pile areas or as a result of overland travel routes.
- TGP will follow the Paleontological Monitoring Plan that has been prepared for this project, including arranging for, in coordination with the BLM, an intensive survey of all areas underlain by geologic units determined by the BLM to have a PFYC Class 4 or higher and coordination regarding any necessary re-routes.

2.1.11.3. Special Status Species

- TGP would contract a BLM-approved biologist to conduct a pre-construction survey of areas to be disturbed within the Lease Area for sand cholla. TGP would avoid any discovered sand cholla to the extent practicable. If a sand cholla needs to be disturbed, it would be transplanted by a BLM-approved biologist or other approved resource specialist to suitable nearby habitat within the Project Area. The BLM-approved seed mixtures as shown in Table 2.11, Proposed Seed Mix, would be used.

2.1.11.4. Vegetation

- TGP would consult with BLM regarding the timing of reseeding, specific seed mixtures, and application rates to be used to improve the success of reseeding.
- Disturbed areas would be re-contoured to blend with the surrounding topography. Topsoil would be salvaged whenever possible and reused in a timely manner.
- Impacts to vegetation would be minimized by reseeding all areas of access roads and well pads not required for subsequent energy production using weed-free and BLM-approved seed mixtures.

Table 2.11. Proposed Seed Mix

Species	PLS lbs./acre	Bulk lbs./acre	PLS/sq. ft.
Fourwing saltbush	3.00	5.00	4
Shadscale	3.00	5.00	4
Indian ricegrass	1.00	1.25	4
Other native seed as approved by BLM	TBD	TBD	TBD
Totals	~7.50	~12.00	~17
Note: PLS = Pure Live Seeds			

2.1.11.5. Invasive, Non-Native Species

- Prior to construction, TGP will submit to BLM an invasive plant management plan to monitor and control noxious weeds. At a minimum, the plan would incorporate the following measures:
    - Existing weed infestations would be treated prior to disturbance. The location of the weeds would be communicated to the Humboldt River Field Office weed coordinator, and treatment methods and herbicides used would be discussed prior to treatment."
    - Herbicides would be applied per label instructions.
    - BLM or other personnel applying herbicides would use personal protective equipment while spraying or handling herbicides.
    - Herbicide application operations would be suspended when wind speed exceeds 6 miles per hour or when precipitation is imminent.
    - Some treatment areas could be signed, if needed, indicating the herbicide used and the date of treatment. Areas which that are isolated and/or receive very little use by human beings would not be signed.
    - During herbicide treatments, a pre-application sweep of the area would be completed (i.e., looking for nesting birds). Any areas that become infested with weeds during construction would be mapped and treated.

2.1.11.6. Raptors

- A Bird and Bat Conservation Strategy/Eagle Conservation Plan has been prepared and is being reviewed by the US Fish and Wildlife Service. TGP would comply with all protective measures included in the finalized version of the plan that has been approved by the US Fish and Wildlife Service. (By policy, this approval is necessary prior to the BLM issuing a decision on this project). This is discussed further in Section 4.2.4.18. TGP commits to the protective measures included in this draft version of the plan. These measures are considered part of the Proposed Action:
    - Structures would be constructed to conform to those practices described in Suggested Practices for Raptor Protection on Power Lines (APLIC 2006).
    - TGP will install bird flight diverters (visual markers) on gen-tie lines in areas with concentrations of raptors or other migrating birds to prevent mid-flight collisions. The number and color configurations would be determined in coordination with the BLM and NDOW. TGP would maintain or replace diverters as needed for the life of the project.
    - TGP will install perch-deterrent devices on all transmission structures within three miles of greater sage-grouse habitat to reduce raptor and corvid (ravens, etc.) use. The ultimate location in the application area will be determined in coordination with the BLM and NDOW.
    - TGP will use lighting directed downward onto the site only and away from adjacent areas. TGP will utilize lighting that is hooded and shielded for all lighting associated with the project, so as not to allow the bulb to shine up or out, with the exception of vehicle headlamps and lighting required by the Federal Aviation Administration.
    - TGP would avoid to the extent practicable any construction activities within 200 yards of identified bat colonies during the bat hibernation season of September 15th through April 30th.
    - Wells and roads would be recontoured and reseeded following completion of the Proposed Action. Erosion-control measures would be implemented and topsoil would be salvaged and reused whenever possible and in a timely manner.
    - Surface-disturbing activities during the migratory bird nesting season (April through July) may be restricted in order to avoid potential violation of the Migratory Bird Treaty Act.
    - TGP would conduct a pre-construction burrowing owl survey and nesting bird survey. If any active nests are found in proximity to work areas, a buffer zone would be established around the nest and work would be avoided in this area until after young have fledged.
    - The MBTA and stipulations of the geothermal leases held by TGP address requirements related to ground-disturbing activities during the migratory bird nesting season. In order to meet these requirements, either habitat for migratory birds would be eliminated within areas of proposed disturbance prior to the nesting season, or migratory bird nest surveys would be conducted no more than two weeks prior to surface disturbing activities by a qualified biologist acceptable to the BLM. 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, TGP would coordinate with the BLM to

develop appropriate protection measures for these sites, which may include avoidance, construction constraints, and the establishment of buffers.

- Use existing roads to the extent possible.
- Avoid construction designs (including structures such as meteorological towers) that increase the risk of collision, such as guy wires. If guy wires are used, mark them with bird flight diverters (according to the manufacturer's recommendation).
- Personnel will be trained to be alert for wildlife at all times, especially during low visibility conditions.
- Personnel, contractors, and visitors will be instructed to avoid disturbing wildlife, especially during the breeding seasons and seasonal periods of stress.

2.1.11.7. Sage-Grouse

- TGP would install perch-deterrent devices on all transmission structures within three miles of Greater sage-grouse Preliminary General Habitat to reduce raptor and corvid (ravens, etc.,) use. The ultimate location in the application area would be determined in coordination with the BLM and the Nevada Department of Wildlife.

2.1.11.8. Migratory Birds

- Migratory bird protection measures are listed under Section 2.2.11.6, Raptors, which discusses the Bird and Bat Conservation Strategy/Eagle Conservation Plan.

2.1.11.9. Bats

- Bat protection measures are listed under Section 2.2.11.6, Raptors, which discusses the Bird and Bat Conservation Strategy/Eagle Conservation Plan.

2.1.11.10. Air Quality

- Surface access roads with aggregate materials, wherever appropriate.
- Post and enforce speed limits to reduce fugitive dust (speed limit of 25 miles per hour, as necessary).
- Apply dust abatement techniques to earthmoving, excavating, trenching, and grading activities (such as watering, requiring loader buckets to be emptied slowly, minimizing drop heights, etc.).
- Minimize equipment and vehicle idling times during construction activities.
- Van-pooling of employees between the Lovelock area and the plant site would be encouraged.

2.1.11.11. Navy Aircraft

- TGP would install aerial marker balls on portions of any installed transmission line identified by Naval Air Station Fallon as an area of frequent low altitude overflights. Aerial marker balls would allow the power lines to be visible to aircraft pilots and minimize collision risk.

2.1.11.12. Fire Resources

- All construction and operating equipment would be equipped with applicable exhaust spark arresters.
- Personnel would be trained in fire prevention and initial response, and fire extinguishers would be available at each drill site.
- Water that is used for construction and operations would be available for fire suppression.
- Personnel would be allowed to smoke only in designated areas and would be required to follow applicable BLM regulations regarding smoking.

2.1.11.13. Lands and Realty

- Applicant shall contact right-of-way holder for location on underground utilities.
- TGP would coordinate with the owner of any fences intersected by project components and would arrange for the temporary removal of sections of fences for construction access, and for the reinstallation of fences and gates, as needed, to provide access for maintenance activities. Any modifications to existing fences would be done only with prior agreement from the affected fence owner and would be paid for by TGP.

2.1.11.14. Range Resources

- TGP has committed to fence pits in conformance with the Gold Book pages 17-18 (BLM 2007).

2.1.11.15. Wild Horse and Burros Resources

- TGP would underground segments of the pipeline in areas to facilitate wild horse passage. TGP would locate these undergrounded segments wherever a wild horse trail is identified up to every mile. Each buried segment would be at least 20 feet in length. Particular focus would be placed on maintaining access to Kitten Springs and Logan Spring. Locations would be developed in coordination with the BLM.
- TGP would ensure that its employees and all contractors are aware that it is illegal to chase or harass wild horses per the Wild Free Roaming Horse and Burro Act of 1971.

2.1.11.16. Soils

- A Spill Prevention, Control, and Countermeasure plan would be implemented to prevent the release of hazardous materials to the environment which could affect soil resources.

- The operator would construct sumps and pits adequate, but not larger than proposed use. Operator would also comply with Nevada Division of Environmental Protection requirements to minimize sump slopes, which may result in a larger sump area. Topsoil would be salvaged and reused whenever possible and in a timely manner.

- Temporarily disturbed areas would be reseeded where previously vegetated using a BLM approved seed mixture.

- Erosion control measures, including but not limited to silt fencing, diversion ditches, water bars, temporary mulching and seeding, and application of gravel or rip rap, would be installed, where necessary, at the beginning of construction activities to avoid erosion and runoff.

- Access roads would follow existing contours to the maximum extent possible. In areas where new access roads must be constructed across slopes, erosion control measures would be installed as necessary, in accordance with Gold Book standards (BLM 2007).

- An average of 6 inches of gravel would be used as road surface because roads would be used during all seasons. Up to 3 feet of gravel may be used on some sections of road and no gravel would be used on road sections where the natural surface is adequate.

- Additional gravel would be laid down when ground conditions are wet enough to cause rutting or other noticeable surface deformation and severe compaction. As a general rule, if vehicles or other project equipment create ruts in excess of 4 inches deep when traveling cross-country over wet soils, the soil shall be deemed too wet for vehicle use, without the application of a gravel surface.

- If construction occurs in areas of very soft soils, up to 3 feet of aggregate would be used.

- An NDEP BAPC Surface Area Disturbance (SAD) permit documenting the best practical management practices to be used, would be required for the project because the surface disturbed by the project would be greater than 5 acres.

2.1.11.17. Water Resources

- Development of a construction Stormwater Pollution Prevention Plan and Spill Prevention, Control, and Countermeasures plan.

- Erosion-control measures would be implemented.

- When permanent new access roads must cross ephemeral washes, rolling dips would be installed. The rolling dips would be designed to accommodate flows from at least a 25year storm event. Culverts may be used wherever rolling dips are not feasible.

- Settled bentonite clay from drilling mud would accumulate on the bottom of the drill pad reserve pits and central sump to act as an unconsolidated clay liner, reducing the potential for drilling fluid to percolate to groundwater.

- A BLM-approved grouting and casing program for construction of observation wells would be implemented to prevent water quality effects on groundwater during or after well installation.

- Borehole geophysics analyses (cement bond logs) would be conducted to document that well casing grouting activities provide an effective seal isolating the geothermal aquifer from shallow alluvial aquifers, therefore minimizing potential impacts on surface springs or streams.
- The project would use BMPs to ensure that any geothermal fluid encountered during the drilling does not flow uncontrolled to the surface. These include the use of "blow-out" prevention equipment during drilling and the installation of well casing cemented into the ground.
- TGP would obtain necessary permits from NDEP for working in ephemeral streambeds and for groundwater discharge and provide a Notice of Intent to NDEP prior to well pad construction.
- TGP would submit a Geothermal Drilling Permit application, including detailed drilling and casing procedures, to BLM for approval prior to initiating geothermal drilling.
- In order to prevent a release of geothermal fluids to surface water features, drilling muds and geothermal fluids would be contained in the well pad reserve pit; or piped or trucked to the large central sump when quantities dictate.
- To avoid communication between the geothermal aquifer and the shallow groundwater aquifer, BMPs for well installation and testing would be implemented.
- A monitoring plan would be put in place to assess whether impacts to quality, quantity, or temperature of surface water occurred as a result of observation well installation and testing.
- TGP will implement a spring inventory for Logan Spring and Taylor Spring following a protocol established by BLM in January 2012 and agreed upon by TGP. This spring inventory would be conducted prior to any exploration activities and would provide baseline conditions at each of the two springs for use in analyzing the results of future monitoring at those springs as part of the Water Resources Monitoring Plan.

2.1.11.18. Visual Resources

- Well heads, pipelines, power plants and buildings would be painted a color that blends with the surrounding area, as approved by the BLM.
- All lights associated with drill rigs, well test facilities and the power plant would be limited to those required to safely conduct the operations, and would be shielded and/or directed in a manner that focuses direct light to the immediate work area.
- To avoid light pollution onto adjacent areas as viewed from a distance, TGP would utilize lighting directed downward on to the site only and away from adjacent areas. TGP would utilize lighting that is hooded and shielded for all lighting associated with the project so as not to allow the bulb to shine up or out with the exception of vehicle headlamps and lighting required by the Federal Aviation Administration.

2.1.11.19. Wastes, Hazardous or Solid

- Small quantities of solid wastes (paper, plastic, and other garbage) generated by the Proposed Action would be transported offsite to an appropriate landfill facility.
- Portable chemical toilet wastes would be removed by a local contractor.

- Sewage generated at the power plant would be treated in an on-site, state-permitted septic system.
- The Spill Prevention, Control, and Countermeasure plan would be submitted to and approved by the BLM and made readily available on site before operations begin.
- Secondary containment structures would be provided for all chemical and petroleum/oil storage areas during drilling operations. Additionally, absorbent pads or sheets would be placed under likely spill sources and spill kits would be maintained on site during construction and drilling activities to provide prompt response to accidental leaks or spills of chemicals and petroleum products.
- Handling, storage, and disposal of hazardous materials, hazardous wastes, and solid wastes would be conducted in conformance with federal and state regulations to prevent soil, groundwater, or surface water contamination and associated adverse effects on the environment or worker health and safety.

2.2. Description of Alternatives Analyzed in Detail:

NEPA requires that a reasonable range of alternatives to the Proposed Action be considered that could feasibly meet the objectives of the Proposed Action as defined in the purpose and need for the project [40 CFR 1502.14(a)]. The range of alternatives required is governed by a "rule of reason" (i.e., only those feasible alternatives necessary to permit a reasoned choice need be considered). Reasonable alternatives are those that are practical or feasible based on technical and economic considerations [46 Federal Register 18026 (March 23, 1981), as amended; 51 Federal Register 15618 (April 25, 1986)].

Alternatives to the Proposed Action must be considered and assessed whenever there are unresolved conflicts Involving alternative uses of available resources [BLM NEPA Handbook H-1790-1, page IV-3 (BLM 2008)].

No unresolved conflicts regarding the Proposed Action within the power plant and wellfield area have been identified to drive the creation of any alternatives which would still meet TGP's purpose for the project: to commercially develop the geothermal resources and to construct and operate a commercial geothermal power plant and wellfield. Therefore, no alternatives for activities within this area (other than the required "No Action Alternative") are analyzed in this Environmental Assessment.

An alternative gen-tie route was identified during early communications between TGP and the HRFO as an attractive option to consider in light of possible conflicts with wetlands and sage grouse habitat along the Proposed Action gen-tie route. This alternative gen-tie route is the distinguishing feature of Alternative 1 presented in this EA. The Alternative 1 gen-tie also avoids passing through the rough topography of the Humboldt Range, avoids existing mining activities and avoids identified bat habitat including hibernation sites. This alternative connection route is described below, under Alternative 1.

2.2.1. Alternative 1

Alternative 1 proposes the development of all project features as described under the Proposed Action except for a different gen-tie route and the need for a new substation. As shown in Figure

2, the Alternative 1 gen-tie would be 24 miles in length and would run directly north up Buena Vista Valley to interconnect with the existing NV Energy Tracy-to-Valmy 345-kV transmission line. The Alternative 1 gen-tie would require the construction of a new 5-acre substation at the interconnect point. As shown in Table 2.12, Alternative 1 Disturbed Areas, 272 acres would be disturbed over the long-term (life of the project) with an additional 237 acres being disturbed temporarily during construction and being revegetated at the end of project construction.

Table 2.12. Alternative 1 Disturbed Areas

Facility	Number Required	Area/Dimensions Per Structure	Long-Term[4] Disturbance Area (acres)	Additional Short-Term Disturbance Area (acres)	Previously Approved Disturbance (acres)
Gen-tie Staging Area	1	5 acres contained within 60 acre power plant site	0	0	0
Gen-tie Support Structures[1]	181 support structures	Up to 24 square feet per structure	<1	5	0
Gen-tie construction workspace	181 sites	Up to 220 by 60 feet and 30 by 40 feet	0	55	0
Gen-Tie Wire Setups	8 sites	600 feet by 100 feet	0	11	0
Gen-tie Access Roads	24 miles (126,720 feet)	8 feet wide temporary 4 feet wide (2-track road) long-term	12	23	0
Substation	1	5 acres	5	0	0
Airstrip	1	5,000 feet by 120 feet	14	0	0
Hangar, Parking, Access	1	250 feet by 200 feet	1	0	0
Power Plant and Ancillary Facilities	1	1,170 feet by 2,240 feet	60	0	0
Production Pipeline	17,640 feet	300 feet temporary width, 155 feet long-term	63	59	0
Injection Pipeline	25,123 feet	300 feet temporary width, 155 feet long-term	89	84	0
Pipeline Supports[2]	1,425 supports	Up to 0.70 square feet per structure	<1	0	
Power Plant Access Roads[3]	2.6 miles	25 feet wide	8	0	0
Gravel extraction	1 to 3	Disturbance spread across up to 3 locations	20	0	0
Well Pads	15	350 feet by 350 feet, plus one groundwater well pad of 150 feet by 150 feet	0	0	42

Well-Field Access and Branch Roads	N/A	48,035 feet by 25 feet wide, plus turnouts	0	0	40
Total Disturbed Area			**272**	**237**	**82**

1. Gen-tie support structures would be placed every 700 feet on average, for a total of approximately 181 structures along the expected maximum length of the Alternative 1 gen-tie line. Up to 24 square feet of disturbance for a 3-pole structure, with up to 8 square feet of disturbance per pole.
2. 1,176 supports, spaced 30 feet apart, along 42,763 feet of pipeline.
3. Disturbance acreage using power plant location with the longest access road needed (southern location).
4. Long-term means for the lifetime of the power plant and generation tie-line. Short-term disturbance means for the duration of construction activities. Long-term disturbed areas would be reclaimed using a BLM-approved seed mixture (see Table 2.11, Proposed Seed Mix) at the end of plant life and gen-tie life. Short-term disturbed areas would be similarly revegetated at end of construction activities.

Table 2.13. Alternative 1 Disturbed Areas

Facility	**Number Required**	**Area/Dimensions Per Structure**	**Long-Term[4] Disturbance Area (acres)**	**Additional Short-Term Disturbance Area (acres)**	Previously Approved Disturbance (acres)
Gen-tie staging area	1	5 acres contained within 60 acre power plant site	0	0	0
Gen-tie support structures**1**	181 support structures	Up to 24 square feet per structure	<1	5	0
Gen-tie construction workspace	181 sites	Up to 220 by 60 feet and 30 by 40 feet	0	55	0
Gen-Tie Wire Setups	8 sites	600 feet by 100 feet	0	11	0
Gen-tie Access Roads	24 miles (126,720 feet)	8 feet wide temporary 4 feet wide (2-track road) long-term	12	23	0
Substation	1	5 acres	5	0	0
Airstrip	1	5,000 feet by 120 feet	14	0	0
Hangar, Parking, Access	1	250 feet by 200 feet	1	0	0
Power Plant and Ancillary Facilities	1	1,170 feet by 2,240 feet	60	0	0
Production Pipeline	17,640 feet	300 feet temporary width, 155 feet long-term	63	59	0
Injection Pipeline	25,123 feet	300 feet temporary width, 155 feet long-term	89	84	0
Pipeline Supports**2**	1,425 supports	Up to 0.70 square feet per structure	<1	0	
Power Plant Access Roads**3**	2.6 miles	25 feet wide	8	0	0

Gravel extraction	1 to 3	Disturbance spread across up to 3 locations	20	0	0
Well Pads	15	350 feet by 350 feet, plus one groundwater well pad of 150 feet by 150 feet	0	0	42
Well-Field Access and Branch Roads	N/A	48,035 feet by 25 feet wide, plus turnouts	0	0	40
Total Disturbed Area			**272**	**237**	**82**

1. a Gen-tie support structures would be placed every 700 feet on average, for a total of approximately 181 structures along the expected maximum length of the Alternative 1 gen-tie line. Up to 24 square feet of disturbance for a 3-pole structure, with up to 8 square feet of disturbance per pole.
2. b 1,176 supports, spaced 30 feet apart, along 42,763 feet of pipeline.
3. c Disturbance acreage using power plant location with the longest access road needed (southern location).
4. d Long-term means for the lifetime of the power plant and generation tie-line. Short-term disturbance means for the duration of construction activities. Long-term disturbed areas would be reclaimed using a BLM-approved seed mixture (see Table 2.11, Proposed Seed Mix) at the end of plant life and gen-tie life. Short-term disturbed areas would be similarly revegetated at end of construction activities.

The proposed Alternative 1 gen-tie would travel from the northwestern edge of the Lease Area in a northwesterly direction for approximately 3.5 miles (depending on the power plant site selected). The route would turn approximately north and run approximately 19 miles until it terminates at the Tracy-to-Valmy 345-kV transmission line. Table 2.13, Coordinates of Alternative 1 Gen-Tie Route, lists the coordinates of the Alternative 1 gen-tie route. Land ownership along the route is primarily in a checkerboard pattern, with approximately 18 miles of the 24-mile route being on BLM-managed lands, and approximately 6 miles of the route being on private lands.

Table 2.14. Coordinates of Alternative 1 Gen-Tie Route

Angle Points	Latitude (°N)	Longitude (°W)
NYC Plant	40.067528	118.003253
G PI 10	40.128231	118.081469
G PI 20	40.245960	118.048681
G EOL	40.375886	118.069908

The Alternative 1 gen-tie would require a new 345-kV substation to interconnect the generator lead line into the Tracy-to-Valmy 345 kV line. The substation would cover approximately 5 acres. A D2 345-kV reactor (35 megavolt ampere reactive) would be required for voltage control. The new substation would be sited on BLM-managed lands. TGP would acquire a long-term easement for the substation from the BLM.

Work at the substation site would begin by clearing existing vegetation and grading a level pad for installation of the station. Once the pad is prepared, the site would be secured with an 8-foot chain-link fence. 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, medium gray gravel, 2 inches wide or less, would be spread over the site to a depth of approximately 4 inches. Gravel would be obtained from either a private source or from a BLM managed source. If the gravel is sourced from a BLM-managed source, TGP would enter into supply agreement with the BLM.

As detailed in Table 2.14, Alternative 1 Gravel Requirements, Alternative 1 is estimated to require 41,417 cubic yards of gravel. To take into account the possibility of an underestimation, TGP proposes the use of up to 50,000 cubic yards of gravel for Alternative 1. Sources of gravel are described in Section 2.2.6, Gravel Needs and Sources.

Table 2.15. Alternative 1 Gravel Requirements

	Length (feet)	Width (feet)	Depth (feet)	Total Aggregate (cubic yards)
Airstrip	5,000	100	0.66	12,222
Hangar, Parking, Access	250	200	0.5	926
Power Plant Area – high traffic	2,000	300	0.66	14,667
Power Plant Area – low traffic	1,170	700	0.2	6,067
Gen-Tie Access Roads	1,500	12	0.5	334
Substation	470	470	0.33	2,700
Power Plant Access Roads	13,728	18	0.5	4,576
Total Aggregate Required:				**41,434**

2.2.2. No Action Alternative

Previously approved actions in the Project Area would continue and would have effects on the environment the New York Canyon Geothermal Exploration Project would occur. This project was analyzed in the New York Canyon Geothermal Exploration EA (DOI-BLM-NV-W010-2010-0004-EA). Well pads would be developed, geothermal wells would be drilled and flow tested, and temporary access roads would be constructed. All of these project features would be removed and the landscape would be revegetated per BLM guidance. Along the gen-tie portions of the Project Area, other ongoing and proposed activities would continue, such as grazing, mining, and dispersed recreation.

2.3. Alternatives Considered But Not Analyzed in Detail

Because the purpose of the project was to develop geothermal resources in the Lease Area and to bring generated electricity to the existing electric grid, alternatives considered were generally limited to where the power plant would be located and how the electricity would be brought to market. Both the Proposed Action and Alternative 1 identify the same four candidate power plant sites within that Lease Area. This flexibility of plant location is needed by TGP and the plant location would be largely determined by the location of a viable geothermal resource within the Lease Area. Since this was a need of TGP, the power plant flexibility needed to be a component of any individual alternative. The candidate power plant locations were, however, selected to avoid the southern portion of the Lease Area, which was identified during the Exploration EA process to be sensitive to Native American resources. The candidate power plant locations were

also selected to avoid ephemeral streams, existing right-of-ways and range improvements. Due to this built-in need for flexibility in plant siting and the active avoidance of identified sensitive environmental and Native American resources, no other alternatives were deemed necessary related to power plant location. What remained in terms of alternatives to be analyzed was the routing of the gen-tie line.

TGP identified three feasible points to tie electricity generated from the Lease Area into the existing regional electrical grid. The first identified point is addressed in the Proposed Action, which would be to bring electricity to the Oreana Substation to the northwest. The second identified point is addressed in Alternative 1, which would bring electricity to the existing 345 kV line to the north via a new substation. The third identified point was considered but eliminated from full analysis in this EA, and that was to bring electricity to the existing TGP-owned 230 kV line in Dixie Valley. This third but eliminated alternative, referred to as the Fencemaker Pass Route is discussed more fully below.

As shown in Figure 9, Alternative Eliminated from Detailed Analysis, the Fencemaker Pass Route would have resulted in the 230 kV gen-tie line running eastward from the northern portion of the Lease Area across Fencemaker Pass, down into Dixie Valley, and south to the existing TGP-owned Dixie Valley geothermal power plant, where the line would then connect into the existing TGP-owned Dixie Valley line. The Dixie Valley line ties into the California electrical grid. At 16 miles in length, the Fencemaker Pass route would have been the shortest route to the electrical grid.

The Fencemaker Pass route was studied in support of this project. On-the-ground surveys for vegetation, wildlife and archaeology were conducted for this route, as well as helicopter surveys for golden eagle nesting sites. Additionally, an ethnographic study was conducted to determine the eligibility of Native American traditional use sites in the Fencemaker Pass area for official listing as potential Traditional Cultural Properties on the National Register of Historic Places. The need to study these sites through an ethnographic study was identified during consultation and communications that TGP and the BLM had with the Fallon Paiute-Shoshone Tribe and the Lovelock Paiute Tribe during the Environmental Assessment conducted for the exploration phase of development in the 2008-2010 timeframe. In support of this current Proposed Action and to evaluate impacts on traditional use sites from power plant construction and operation and from construction of the Fencemaker Pass gen-tie line, the Fallon Paiute-Shoshone and Lovelock Paiute Tribes were engaged by the BLM in formal government-to-government consultation under Section 106 of the National Historic Preservation Act. Visual simulations were prepared for all traditional use sites identified by the Tribes and these simulations were presented to the Tribal councils by the BLM in late 2012. After reviewing the project materials and visual simulations, the Tribes expressed discontent with the proximity and visibility of the Fencemaker Pass route to some of their traditional use sites. The proposed Fencemaker gen-tie route would pass through one NRHP eligible TCP and was highly visible from several other TCPs. The Tribes also expressed concern regarding the number of Pinyon trees that would need to be cut down within and around a NRHP eligible TCP to construct this gen-tie line.

A Fencemaker Pass route was considered as part of the original development proposal as the applicant wanted the option of delivering power to California. Based on the resource concerns involved with this route and the time that would have been involved in designing and evaluating an alternative to this route, TGP opted to drop this route from their proposal.

2.4. Conformance

The proposed geothermal operations and gen-tie construction conform to applicable provisions of the Management Framework Plan.

The public land within the geothermal operations area and along the transmission line corridor is administered by the BLM through the Winnemucca District, HRFO. The area is subject to the BLM Winnemucca District *Sonoma-Gerlach Management Framework Plan (MFP), 1982* and its geothermal leasing amendment, *Record of Decision and Resource Management Plan Amendments for Geothermal Leasing in the Western United States, December 2008*. The Management Framework Plan and its amendment allow for geothermal development at this location.

Figure 2. Overview of Proposed Action and Alternative 1

Figure 3. Geothermal Development Area

Figure 4. 230 kV Wood H-Frame Structure

Figure 5. 230 kV Three—Pole Structure

Figure 6. Candidate Plant Locations and Access Roads

Figure 7. Plant General Arrangement

Figure 8. Example Power Plant Photos

Figure 9. Alternative Eliminated from Detailed Analysis

Chapter 3. Description of the Affected Environment:

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To comply with the NEPA, the BLM is required to consider specific elements of the human environment that are subject to requirements specified in statute or regulation or by executive order. The following tables (Table 3.1 and Table 3.2) outline the elements that must be considered in all environmental analyses, as well as additional resources deemed necessary for evaluation by the BLM, and denotes if the Proposed Action or Alternatives affects those elements.

Table 3.1. Supplemental Authorities

Supplemental Authority	Not Present	Present/Not Affected	Present/May Be Affected	Rationale
Air Quality			X	See Sections 3.1, 4.1.1
Areas of Critical Environmental Concern	X			The Proposed Action is not located in or near any existing ACECs.
Cultural Resources			X	See Sections 3.2, 4.1.2
Environmental Justice			X	The Proposed Action would be located in an undeveloped, geographically remote area without any existing community or population. Environmental justice issues are discussed in the context of Native American Religious Concerns. See Section 3.16 and 4.1.16, Social and Economic Values, and Sections 3.5, 4.1.5, Native American Religious Concerns.
Floodplains	X			There are no Federal Emergency Management Agency-designated 100-year floodplains within the Project Area.
Invasive, Nonnative Species			X	See Sections 3.3, 4.1.3
Migratory Birds			X	See Sections 3.4, 4.1.4
Native American Religious Concerns			X	See Sections 3.5, 4.1.5
Prime or Unique Farmlands			X	See Sections 3.6, 4.1.6
Threatened or Endangered Species	X			There are no federally threatened or endangered species within the Lease Area boundaries or within areas required for ROW.
Wastes, Hazardous or Solid			X	See Sections 3.7, 4.1.8

Water Quality (Surface/Ground)			X	See Sections 3.8, 4.1.8
Wetlands/Riparian Zones			X	See Sections 3.9, 4.1.9
Wild and Scenic Rivers	X			There are no wild and scenic rivers in the Project Area boundaries.
Wilderness	X			There are no federally designated wilderness areas within the Project Area boundaries.

Table 3.2. Additional Affected Resources

Resource or Use	Not Present	Present/Not Affected	Present/May Be Affected	Rationale
Access and Transportation			X	See Sections 3.10, 4.1.10
Fire Management			X	See Sections 3.11, 4.1.11
Fisheries Resources	X			There are no fisheries in the vicinity of the Project Area.
Geology and Minerals		X		Proposed action is a fluid mineral extraction project and is compatible with mining in the area. No unique geologic features present in Project Area.
Lands and Realty			X	See Sections 3.12, 4.1.12
Lands with Wilderness Characteristics	X			Wilderness Characteristics Inventories for the project area were reviewed. Historical inventories had determined that this area does not possess wilderness characteristics. Current reviews concurred that the areas do not meet the criteria for Lands with Wilderness Characteristics. No further analysis is recommended.
Noise			X	See Sections 3.14, 4.1.14
Paleontological Resources			X	See Sections 3.14, 4.1.14

Range Resources			X	See Sections 3.15, 4.1.15
Social and Economic Values			X	See Sections 3.16, 4.1.16
Soils			X	See Sections 3.17, 4.1.17
Special Status Species			X	See Sections 3.18, 4.1.18
Vegetation			X	See Sections 3.19, 4.1.19
Visual Resources			X	See Sections 3.20, 4.1.20
Water Quantity			X	See Sections 3.21, 4.1.21
Wild Horse Management			X	See Sections 3.22, 4.1.22
Wildlife			X	See Sections 3.23, 4.1.23

3.1. Air Quality

This section describes the climate of the Project Area, describes air quality regulations and conditions, and provides information pertaining to greenhouse gases and climate change. Ambient air quality is affected by the type and amount of air pollutants emitted into the atmosphere, the size and topography of the air basin, prevailing meteorological conditions, and the conversion of air pollutants and other naturally occurring atmospheric constituents by a complex series of chemical and photochemical reactions in the atmosphere. The levels of air pollutants are generally expressed in terms of concentration, either in units of parts per million, parts per billion, or micrograms per cubic meter (µg/m3).

3.1.1. Regional Overview

The Project Area is in an area dominated by recurring high and low pressure systems. The average annual high temperature for the Project Area is 64.8 degrees Fahrenheit (°F). The average annual low temperature is 30°F. The warmest month is July, with an average high temperature of 90°F and an average low temperature of 49°F. The coldest month is January, when the average high temperature is 41°F and the average low temperature is 15°F. Average annual rainfall is 7.72 inches, and average annual snowfall is 16.3 inches (Western Regional Climate Center 2011).

3.1.2. Ambient Air Quality Standards

The US Environmental Protection Agency (EPA) Office of Air Quality Planning and Standards and the NDEP have set National Ambient Air Quality Standards (NAAQS) and Nevada ambient air quality standards for the following criteria pollutants: nitrogen dioxide, sulfur dioxide, carbon monoxide, PM10, PM2.5, ozone, and lead. In addition to the above-listed criteria pollutants, NDEP has established an ambient air quality standard of 0.08 parts per million or 112 µg/m3 for hydrogen sulfide (H2S). Nevada Administrative Code 445B.22097 provides the minimum standards of quality for Nevada ambient air.

Based on measured ambient criteria air pollutant concentrations, EPA classifies areas of the US according to whether they meet the NAAQS. Areas that violate air quality standards are

designated as nonattainment areas for the relevant criteria air pollutants. Areas that comply with air quality standards are designated as attainment areas for the relevant criteria air pollutants. Areas that have been redesignated from nonattainment to attainment are considered maintenance areas. Areas of uncertain status are generally designated as unclassifiable but are treated as attainment areas for regulatory purposes. Pershing and Churchill Counties are designated unclassifiable or attainment for all NAAQS.

The Final Mandatory Reporting of Greenhouse Gases Rule issued by the EPA, as signed on September 22, 2009, requires suppliers of fossil fuels or industrial greenhouse gases, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of greenhouse gases emissions to submit annual reports to the EPA. Geothermal facilities are exempt from geothermal sourced greenhouse gas reporting to EPA.

3.1.3. Regional Air Quality Conditions

Because Pershing and Churchill Counties are designated unclassifiable or attainment for all NAAQS, additional air quality conformity analysis is not required.

The Proposed Action would be located in a rural area with few emissions to the airshed from industrial sources or vehicle traffic. Activities associated with the Proposed Action would occur in Buena Vista Valley (groundwater basin 129), within Pershing County, Nevada. Groundwater basins in the state of Nevada correspond to airsheds, and therefore groundwater basin 129 is the analysis area for air quality. This basin is in attainment for all NAAQS and Nevada air quality standards. In addition, the area is not a maintenance area for any criteria pollutants.

The nearest residences to the potential geothermal plant locations are in Lovelock, over 20 miles northwest of the Geothermal Development Area. Potential human uses in the more immediate Project Area are limited to grazing-related land uses, dispersed recreation, and seasonal Native American pine nut collection. None of these activities occur adjacent to the potential power plant locations.

3.1.4. New York Canyon Meteorological Data

In September 2010, the Project Applicant installed a meteorological station within the Project Area to record hourly meteorological conditions. Wind data collected at the site are shown in Figure 10, Wind Rose Data, New York Canyon Project Area. As shown on the figure, winds enter the Project Area primarily from the southwest, with average wind speeds of less than 20 meters per second (45 miles per hour) but with gusts in excess of 30 meters per second (67 miles per hour).

3.1.5. Greenhouse Gases and Climate Change

Greenhouse gases are gases that allow short-wave solar radiation to enter the Earth's atmosphere, but absorb long-wave infrared radiation re-emitted from the Earth's surface. Over time the amount of energy sent from the sun to the Earth's surface should be approximately the same as the amount of energy radiated back into space, leaving the temperature of the Earth's surface roughly constant. Most studies, however, indicate that the Earth's climate has warmed over the past century and that human activities producing greenhouse gases are likely an important contributing factor. Climate models predict that if greenhouse gases continue to increase, the

average temperature at the Earth's surface could increase from 3.2 to 7.2ºF (1.8 to 4.0 degrees Celsius [ºC]) above 1990 levels by the end of this century (EPA 2011).

3.1.5.1. Regulatory Considerations

3.1.5.1.1. Greenhouse Gas Reporting Rule

The Final Mandatory Reporting of Greenhouse Gases Rule, issued by the EPA on September 22, 2009, requires suppliers of fossil fuels or industrial greenhouse gases, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of greenhouse gas emissions to submit annual reports to the EPA. In recognition of the very low percentage of carbon dioxide that geothermal power plants might emit in comparison to fossil fueled facilities they might offset, geothermal facilities were exempted from geothermal sourced greenhouse gas reporting to EPA.

In 2011 the Nevada Legislature repealed NRS 445B.370, dropping the State requirement from greenhouse gas reporting in favor of the federal EPA greenhouse gas reporting program.

3.1.5.2. Sources of Greenhouses Gas Emissions

Gases exhibiting greenhouse properties come from both natural and human sources. Water vapor, carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) are examples of greenhouse gases that have both natural and manmade sources, while other greenhouse gases, such as chlorofluorocarbons, are exclusively manmade.

In the US, greenhouse gas emissions come mostly from energy use. Such emissions result from combustion of fossil fuels used for electricity generation, transportation, industry, heating, and other needs. Energy-related CO2 emissions represent over 80 percent of total manmade greenhouse gas emissions in the US (US Energy Information Administration 2009). More than half the energy-related emissions come from large stationary sources such as power plants, while approximately one third come from transportation. Industrial processes (such as the production of cement, steel, and aluminum), agriculture, forestry, other land use, and waste management are also important sources of greenhouse gas emissions in the United States (EPA 2011).

In Nevada, electrical generation, transportation, and the combined residential, commercial, and industrial sectors comprise over 90 percent of total greenhouse gas emissions generated in the state. Electrical generation, at about 45 percent, accounted for half of this total amount (NDEP 2011).

3.1.5.3. Effects of Climate Change

The effects of climate change include rising sea levels, shrinking glaciers, changes in the range and distribution of plants and animals, trees blooming earlier, lengthening of growing seasons, ice on rivers and lakes freezing later and breaking up earlier, and thawing of permafrost. In the US, scientists believe that most areas will continue to warm, although some will likely warm more than others. It is difficult to predict which parts of the country will become wetter or drier, but scientists generally expect increased precipitation and evaporation, and drier soil, in the middle parts of the country (EPA 2011). Temperature increases in the western US over the next century are expected to range from 2 to 3ºC at the low end of the uncertainty range to 5 to 6ºC at the upper

end of the uncertainty range. Future warming would be affected by greenhouse gas emission levels, to which human activities contribute (US Forest Service 2011).

In the western US, increased temperatures have led to more precipitation falling as rain rather than snow, earlier snowmelt and snowmelt-driven streamflow, and reduced spring snowpack. Increased temperatures may also result in decreased soil moisture in arid regions of the western US. Warmer temperatures and higher rates of evapotranspiration with climate change in some areas, such as the southwest US, will likely lead to increased drought frequency and severity. Overall, drought-affected areas are projected to increase in extent. Although increased temperatures will likely lead to decreased runoff in some areas, increased frequency of heavy precipitation events will likely lead to increased flood risk in many regions. Earlier snowmelt and runoff resulting from increased temperatures could also lead to increased winter and spring flooding (US Forest Service 2011).

Increasing temperatures and changes in precipitation impact ecosystem structure, components of which include vegetation and wildlife abundance and distribution, and ecosystem processes, such as fire.

3.2. Cultural Resources

The cultural resources assessment area is the Project Area as defined by the Geothermal Development Area and the gen-tie routes proposed under both the Proposed Action and Alternative 1.

Cultural resources encompass both prehistoric and historic sites, and sites of religious importance to Native Americans. Section 106 of the National Historic Preservation Act (16 USC 40 et seq.) requires federal agencies to take into account the effects of their actions on properties listed or eligible for listing on the National Register of Historic Places (NRHP). Eligibility for the NRHP is based on the property's age, location, identity and context, and its capacity to reveal information on the past through research.

Part of the Project Area was surveyed by a Class III cultural resource inventory conducted by Far Western Anthropological Research Group (Far Western) in 2009. In CR2-3043(P) and CR2-3043-2(P) (Young and Garner 2010a; Young and Garner 2010b), thirteen sites are documented. Seven sites are prehistoric with simple flaked stone assemblages. None of these sites are eligible for the NRHP. Four sites are historic resources and are also not considered eligible for the NRHP. Two sites, CRNV-02-9535 and CRNV-02-9577, are traditional routes used by Native Americans to access a NRHP-listed Traditional Cultural Property (TCP). These two routes are NRHP eligible. As BLM recommended, mitigation measures in the Exploration EA, TGP was not allowed to use the roads and a 50-meter avoidance area was placed around each. A Class III cultural survey for the geothermal power plant and its ancillary facilities was conducted by Western Cultural Resource Management, Inc. in the summer of 2011. Seventeen new sites were recorded. Only CRNV-2-11083, a historic mercury mining complex, is considered eligible for the NRHP.

Several cairns (manmade rock piles of stones) are found within the Lease Area. For their protection, the exact locations of these cairns are not public information.

Class III cultural surveys were done by Far Western and SWCA Environmental Consultants for possible transmission line routes from the plant area. Transmission line routes over the

Stillwater Mountains are discussed in Far Western reports CR2-3043-1(P), CR2-3043-2(P), and CR2-3195(P), and SWCA report CR2-3112. Transmission line routes to the north of the plant area are discussed in SWCA report CR2-3112.

The Gen-Tie West route connecting to the substation located at T29N R33E section 33 passes through the Rochester Historic Mining District. The route avoids contributing elements and is not considered to present a visual impact to the setting of the Rochester Historic Mining District.

3.3. Invasive, Non-Native Species

3.3.1. Regulatory Background

3.3.1.1. Federal Noxious Weed Act of 1974

This law 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 Federal Noxious Weed 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.

3.3.1.2. Executive Order 13112, Invasive Species

Signed in 1999, this Executive Order directs federal agencies to prevent the introduction of invasive species, to provide for their control, and to minimize the economic, ecological, and human health impacts caused by invasive species. To do this, the Executive Order established the National Invasive Species Council. Currently, there are 13 departments and agencies on the Council. Nevada Revised Statutes 555, Control of Insects, Pests, and Noxious Weeds This law advises that the control of noxious weeds is the responsibility of every landowner or occupant. The statute includes the laws by which noxious weeds and other pests are designated and regulated by the Nevada Department of Agriculture. It gives the current noxious weed list for the State of Nevada and creates weed control districts to help control and eradicate noxious weeds.

3.3.2. Methods

Information regarding invasive and nonnative species within the Project Area is based on the results of biological studies conducted in support of the project between 2009 and 2011 (CH2M HILL 2009, EMPSi 2012). Biological resource surveys were conducted, and existing information was reviewed, as described in Section 3.19, Vegetation. During surveys, invasive nonnative species were documented and noted on survey forms, although an intensive thorough survey for invasive, nonnative species was not conducted.

3.3.3. Regional Overview

The State of Nevada lists 47 noxious weed species that require control (Nevada Administrative Code 555.10) (Nevada Department of Agriculture 2008). They are split into three categories based on distribution and level of control required by the state.

3.3.4. Geothermal Development Area

No noxious weed species were observed during the field survey of the New York Canyon Geothermal Development Area. However, the following invasive, non-native species were identified within the Geothermal Development Area: cheatgrass (*Bromus tectorum*), red brome, flixweed, and clasping pepperweed (CH2M HILL 2009).

3.3.5. Proposed Action Gen-Tie Route Project Area

Hoary cress (*Cardaria draba*) and perennial pepperweed (*Lepidium latifolium*) were the only noxious weeds identified along the Proposed Action Gen-Tie Route during field surveys. In addition, the following non-listed invasive, non-native species were identified along the Proposed Action Gen-tie Route: bur buttercup, clasping pepperweed, cheatgrass, and annual wheatgrass (*Eremopyrum triticeum*) (EMPSi 2012).

3.3.6. Alternative 1 Gen-Tie Route Project Area

The occurrence of noxious weeds along the Alternative 1 Gen-Tie Route was similar those seen along the Proposed Action Gen-Tie Route (EMPSi 2012).

3.4. Migratory Birds

3.4.1. Regulatory Background

3.4.1.1. Migratory Bird Treaty Act of 1918

The Migratory Bird Treaty Act implements a series of international treaties that provide for migratory bird protection. The Act authorizes the Secretary of the Interior to regulate the taking of migratory birds. The act provides that it shall be unlawful, except as permitted by regulations, "to pursue, take, or kill any migratory bird, or any part, nest or egg of any such bird" (16 USC 703) but does not regulate habitat. The list of species protected by the Act was revised in March 2010 and includes almost all bird species (1,007 species) that are native to the US.

3.4.1.2. Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

Signed on January 11, 2001, this Executive Order directs each federal agency taking actions that are likely to have a measureable effect on migratory bird populations to develop and implement a Memorandum of Understanding with the US Fish and Wildlife Service (USFWS) that promotes the conservation of migratory bird populations.

3.4.1.3. Memorandum of Understanding to Promote the Conservation of Migratory Birds

On April 12, 2010, the USFWS and BLM signed this Memorandum of Understanding pursuant to Executive Order 13186. The purpose of this Memorandum of Understanding 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 USFWS and BLM, in coordination with state, tribal, and local governments. This Memorandum of Understanding identifies specific activities where cooperation between the USFWS and BLM will contribute to the conservation of migratory birds and their habitat.

3.4.1.4. Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (1940, as amended 1959, 1962, 1972, 1978) prohibits the take or possession of bald and golden eagles with limited exceptions. Take, as defined in the Act, includes "to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." 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, injury to an eagle; 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. An important eagle-use area is defined in the Act 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 that are essential for the continued viability of the site for breeding, feeding, or sheltering eagles.

The BLM requires consideration and NEPA analysis of golden eagles and their habitat for all renewable energy projects (BLM IM No. 2010-156). The BLM Instruction Memorandum (IM) on Golden Eagles provides direction for complying with the Act, including its implementing regulations (i.e., Eagle Rule, 50 CFR parts 13 and 22) for golden eagles, and to identify steps that may be necessary within the habitat of golden eagles to ensure environmentally responsible authorization and development of renewable energy resources (BLM 2010b). The IM primarily addresses golden eagles, because a process to acquire take permits for bald eagles already exists. The IM is applicable until the USFWS establishes criteria for programmatic golden eagle permits.

3.4.2. Methods

Information regarding migratory bird species within the Project Area is based on the results of biological studies conducted in support of the project between 2009 and 2011 (CH2M HILL 2009, EMPSi 2012). Biological resource surveys were conducted for migratory birds, and existing information was reviewed, as described in Section 3.19, Vegetation, and Section 3.23, Wildlife. Ground burrows were examined for evidence of burrowing owls (e.g. feathers, pellets with insect exoskeletons, scat). However, a protocol-level burrowing owl survey and a comprehensive survey for nesting birds were not conducted. BLM sensitive and other special status bird species are discussed in Section 3.18, Special Status Species.

3.4.3. Regional Overview

Based on the variety of habitats observed, numerous migratory bird species have the potential to exist within the Project Area. Sixty species were observed during field surveys throughout the Project Area.

All birds in the Winnemucca District are considered neotropical migratory birds except for the gallinaceous (upland game) birds such as California quail (*Lophortyx californicus*), chukar (*Alectoris chukar*), and sage-grouse (*Centrocercus urophasianus*). The one Game Bird Below

Desired Condition that could occur within the Project Area is the mourning dove (*Zenaida macroura*). Birds of Conservation Concern potentially inhabiting the Project Area are presented in Table 3.3, Birds of Conservation Concern Potentially Occurring Within the Project Area. Thirteen Bird Species of Conservation Concern have the potential to inhabit the Project Area (EMPSi 2012).

Table 3.3. Birds of Conservation Concern Potentially Occurring Within the Project Area

Species	Habitat	Potential for Occurrence		
		Geothermal Development Area	Gen-tie	
			Proposed Action	Alternative 1
Long-billed curlew *Numenius americanus*	Grasslands and irrigated agricultural fields.	Potential to occur	Potential to occur	Potential to occur
Golden eagle *Aquila chrysaetos*	Variety of open and semi-open landscapes with sufficient mammalian prey base and cliff sites for nesting.	Potential to occur	Confirmed	Confirmed
Prairie falcon *Falco mexicanus*	Nests on cliffs. Forages over a variety of shrub habitats, agricultural crops, and native perennial grasses. Avoids dense cheatgrass.	Potential to occur	Confirmed	Potential to occur
Peregrine falcon *Falco peregrinus*	Cliffs with suitable avian prey populations. Usually breeds in proximity to a water body.	Potential to occur	Potential to occur	Potential to occur
Swainson's hawk *Buteo swainsoni*	Usually found close to riparian or other wet habitats; forages over agricultural fields, wet meadows, or open shrublands.	Potential to occur	Potential to occur	Potential to occur
Ferruginous hawk *Buteo regalis*	Grasslands and semidesert shrublands. Nests in isolated trees, on rock outcrops, or ground.	Confirmed. Observed during 2009 surveys	Potential to occur	Potential to occur
Greater sage-grouse *Centrocercus urophasianus*	Sagebrush, montane shrubland, wet meadow.	Potential to occur	Potential to occur	Potential to occur
Burrowing owl *Athene cunicularia*	Treeless areas with low vegetation and burrows.	Potential to occur	Potential to occur	Potential to occur
Short-eared owl *Asio flammeus*	Wet meadow or grassland bordered by open shrublands or other dry habitat.	Potential to occur	Potential to occur	Potential to occur

Loggerhead shrike *Lanius ludovicianus*	Open country with scattered trees and shrubs, desert scrub. Nests in shrubs or small trees.	Potential to occur	Confirmed	Potential to occur
Pinyon jay *Gymnorhinus cyanocephalus*	Pinyon pine, juniper, sagebrush, occasionally ponderosa or Jeffrey pine.	Potential to occur	Potential to occur	Potential to occur
Brewer's sparrow *Spizella breweri*	Sagebrush, greasewood, perennial upland grasslands.	Potential to occur	Potential to occur	Potential to occur
Juniper titmouse *Baeolophus griseus*	Pinyon-juniper woodlands.	Unlikely to occur	Unlikely to occur	Unlikely to occur
Source: Great Basin Bird Observatory 2010; NatureServe 2011; Wildlife Action Plan Team 2006				

3.4.4. Geothermal Development Area

Based on the variety of habitats observed, numerous migratory bird species have the potential to occur within the Geothermal Development Area. The 2009 biological survey did not provide information on the specific migratory bird species found within the Geothermal Development Area. However, due to its proximity to the three gen-tie routes, it can be assumed that the Geothermal Development Area would support many of the same avian species (EMPSi 2012).

3.4.5. Proposed Action Gen-Tie Route Project Area

Based on the variety of habitats observed, numerous migratory bird species have the potential to exist along the Proposed Action Gen-Tie Route. During field surveys, twenty-one avian species were observed along the Proposed Action Gen-Tie Route. Of these, three were Birds of Conservation Concern. Eight other Birds of Conservation Concern have the potential to exist along this gen-tie route. In addition, Nevada Department of Wildlife has indicated that the following avian species have the potential to exist along the Proposed Action Gen-Tie Route: turkey vulture (*Cathartes aura*), red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), great horned owl (*Bubo virginianus*), and barn owl (*Tyto alba*) (EMPSi 2012). Golden eagles are discussed in Section 3.18, Special Status Species.

3.4.6. Alternative 1 Gen-Tie Route Project Area

Based on the variety of habitats observed, numerous migratory bird species have the potential to exist along the Alternative 1 Gen-Tie Route. Seven species were observed during field surveys. Of these, golden eagle, a species of conservation concern was observed along this gen-tie route. Eight other Birds of Conservation Concern have the potential to exist along the Alternative 1 Gen-Tie Route. In addition, the Nevada Department of Wildlife has indicated that the red-tailed hawk has the potential to exist along the Alternative 1 Gen-Tie Route (EMPSi 2012).

3.5. Native American Religious Concerns

The Native American Assessment Area is shown in Figure 11, Native American Assessment Area, and includes the town of Fallon to the southwest, the Fallon Indian Reservation to the south, and the northern reach of the gen-tie routes for the northern boundary. In the west, it includes the town of Lovelock and the Lovelock Paiute Indian Colony. To the east, the assessment area includes the Stillwater range and reaches to the portion of Dixie Valley that contains the Dixie Valley Power Plant.

Numerous laws and regulations require the BLM to consider Native American concerns. These include the National Historic Preservation Act, the American Indian Religious Freedom Act of 1978, Executive Order 13007 (Indian Sacred Sites), Executive Order 13175 (Consultation and Coordination with Tribal Governments), the Native American Graves Protection and Repatriation Act, the Archaeological Resources Protection Act, as well as NEPA and the Federal Land Policy and Management Act. Secretarial Order No. 3317, issued in December 2011, updates, expands and clarifies the Department of Interior's policy on consultation with Native American tribes. The BLM also utilizes H-8120-1(General Procedural Guidance for Native American Consultation) and National Register Bulletin 38 (Guidelines for Evaluating and Documenting Traditional Cultural Properties).

The goal of consultation is for the BLM to identify specific traditional/cultural/spiritual sites, activities, and resources important to Native Americans, and limit, reduce, or possibly eliminate any negative impacts. The American Indian Religious Freedom Act of 1978 and Executive Order 13007 apply to sites used for religious ceremonies or sacred sites. These authorities do not specify criteria for determining whether a project would affect such places. For purposes of the analysis in this EA, a project effect on sites used for religious ceremonies and sacred sites is considered substantial if it restricts access to such sites; impedes the exercise of ceremonies at such sites in some way or form; or affects the physical integrity of such sites. TCPs, which may or may not be sacred sites, have similar substantial project effects thresholds, plus damage to the setting or physical integrity of the TCP. 36 CFR 800.5 (a)(1) lists the criteria for adverse effects on NRHP eligible properties. In determination of the adverse impacts on TCPs, it is important to remember guidance from National Register Bulletin 38 (p.4): "It is vital to evaluate properties thought to have traditional cultural significance from the standpoint of those who may ascribe such significance to them, whatever one's own perception of them, based on one's own cultural values, may be.

Given these concerns and issues over the eligibility of the unevaluated TCPs, an ethnographic study was conducted. Informants came from the Fallon Paiute Shoshone tribe, the Lovelock Paiute tribe, and the Pyramid Lake Paiute tribe. The ethnographic study determined that five of the six unevaluated TCPs were eligible for the NRHP (McBride 2012).

Northern Paiute religious beliefs have been preserved as oral traditions from one generation to the next. As such, it has been poorly documented by anthropologists (Fowler 2002;169). Between bands, common themes ran through religious traditions but there were variations in beliefs. As noted by Hultkrantz (1986:631): "[…] there was no unitary religious system and no world view that provided a dogma of supernatural sanctions. Religious ideas and practices were diffused through the culture but did not constitute a set of defined beliefs, values, and rites."

Common to all Northern Paiute bands is the idea of *puha* (Fowler 2002; Miller 1983). *Puha*, is roughly translated as power, and is a life force that is believed to be in all animate and inanimate

objects. With this in mind, the Northern Paiutes consider the Earth, Moon, Sun, Stars, Fire, Water, and Wind as animate living beings. In Northern Paiute theology, the Earth and humans are considered to be the most powerful beings (Fowler 2002:170).

Since all things have *puha*, as a way of showing respect, the Northern Paiutes have songs, dances and ceremonies that must be performed before using, eating, hunting or collecting certain animals, plants and stones. Many places sacred to the Northern Paiutes are where *puha* exists on the landscape. The local landscapes, being part of the Earth, are thus a critical element in traditional Northern Paiute theology.

The TCPs neighboring the Project Area are all related to the harvesting of pine nuts. While the harvesting is a subsistence activity, associated with the physical harvesting are a variety of other cultural activities that also occur as part of the harvesting. For example, elders can teach the younger generations traditional songs and stories; recipes and traditional food information can be shared; and extended families can be re-united. The point to be emphasized is that the pine nut harvest provides the opportunity for other traditional cultural activities to occur.

While Northern Paiute families have traditional camp sites and pinyon groves, they do not "own" them. Possibly tied to concepts of *puha*, certain trees can be important to individuals and/or their families. From past ethnographic work, these trees have been marked as "seed trees" throughout the range. Given the variability in production of cones and nuts each year, and coupled with the fact that pine nuts are a wintertime staple, access is generally given to others who do not have access to pine nuts.

For traditional Northern Paiutes, pine nut gathering has important cultural links. In the spring, there are ceremonies and dances to insure a good pine nut harvest. In the fall, when the cones are ready to harvest and process, families congregate in their traditional gathering areas and start collecting the cones. Before and during collection, to pay respect to the pine nuts, a variety of ceremonies are performed during the gathering (see McBride 2012; McGuckian 1996, 2003; McGuckian and McBride 2003*). The multi-generational congregation gives a chance for the elders to instruct the children on traditional Northern Paiute knowledge and folklore, and the parents of the children to renew their traditional knowledge.

In the EA for TGP's exploration drilling project (DOI-BLM-NV-W010-2010-0004-EA), members of the Fallon Paiute and Shoshone Tribe and the Lovelock Paiute Tribe voiced the following concerns about geothermal exploration in the New York Canyon area (p. 4-7, 4-8):

1. Direct and indirect impacts to the NRHP listed TCP and 6 unevaluated TCPs. These concerns included visual impacts to the setting of the TCPs.

2. Adverse impacts to the traditional routes into the TCPs.

3. Increased access to the area by the public.

4. Impacts to springs in the area.

5. Increased fire risk.

Results of the Native American Consultation process are discussed in Section 4.1.5, Native American Religious Concerns.

3.6. Prime or Unique Farmlands

Prime or unique farmlands are addressed under Section 3.17, Soils.

3.7. Wastes, Hazardous or Solid

The EPA's Envirofacts and Enviromapper websites were accessed and the Geothermal Development Area as well as the Proposed Action and Alternative 1 gen-tie ROWs were searched for any records of past contamination. No soil or water contamination or hazardous wastes or hazardous materials are known to occur in the Geothermal Development Area or within the Alternative 1 gen-tie route. The portion of the Proposed Action gen-tie route that passes through the Coeur Rochester mine could contain soils contaminated with chromium, lead, manganese, mercury, nickel and nitrates. In 2011, the Coeur Rochester Mine also had recorded releases to the air of chromium, cyanide compounds, lead compounds, manganese, mercury compounds, nickel, and silver compounds, so these releases could be ongoing, either continuously or intermittently (US Environmental Protection Agency 2013a). The nearest registered generators of hazardous waste are the Coeur Rochester Mine and the Oreana Substation (US Environmental Protection Agency 2013b). Numerous federal and state laws and regulations apply to hazardous materials, hazardous waste and solid wastes.

3.8. Water Quality (Surface/Ground)

3.8.1. Regional Overview

The proposed Project Area is located within the 742-square-mile Buena Vista Valley located in the Basin-and-Range Province of north-central Nevada. This internally drained desert basin is designated Nevada Division of Water Resources (NDWR) Groundwater Basin 129 in Nevada Hydrographic Region 10 (Central Region; NDWR 2012). Average annual precipitation for this area is approximately 10 inches (NDEP 2012). The proposed route for the overhead power generation transmission tie line (gen-tie) would extend from the Project Area to the northwest across the Buena Vista Valley and across the Humboldt Range to near the town of Oreana (Proposed Action Gen-Tie Route). Under Alternative 1, the northwest route would be replaced by a northern route extending north through Buena Vista Valley (Alternative 1 Gen-Tie Route).

3.8.2. Surface Water

The New York Canyon Project Area is located in Antelope Valley within the south end of the Buena Vista Valley and within hydrologic unit code 16060001. There are no streams or rivers within this internally drained basin (i.e., playa). As shown in Figure 12, Water Features, ephemeral streams/channels and washes are the only surface water features present in the project area, aside from isolated springs and seasonal pooling water in playas. Ephemeral streams and washes transport surface water periodically during significant rain events and snowmelt. The ephemeral channels and washes extend to the northwest through the Project Area from topographically higher areas of the Stillwater Range and across alluvial fans along the mountain front. Hughes Canyon, Cornish Canyon, and New York Canyon have ephemeral drainage channels that generally flow at least seasonally (BLM 2010).

According to the New York Canyon Geothermal Exploration Project EA (BLM 2010), three ponds are located in the Lease Area, all of which are used by cattle. These ponds are located in washes over 1,000 feet up-gradient from the Project Area. Lumos & Associates (Lumos 2010) reported a manmade stock watering pond at the mouth of New York Canyon that receives periodic channel flow; this pond is located on the up-gradient side of the proposed Project Area.

Several springs are located up-gradient from the Project Area near the base of the Stillwater Mountain Range. None of these springs has been identified as having an elevated temperature (BLM 2010a). Additional information about springs is included below in Section 3.8.3, Groundwater.

There are no "Waters of the US" (wetlands and non-wetland drainage areas) with Clean Water Act jurisdiction (33 CFR 328) located within the proposed geothermal Project Area (BLM 2010a). There are no Federal Emergency Management Agency Flood Insurance Program Mapping special flood hazard or floodway areas within the Project Area (Federal Emergency Management Agency 2009). In addition, since there are no perennial streams or rivers in the Project Area, there are no impaired (303(d) List) water bodies.

3.8.3. Groundwater

Three wells were sampled by TGP on March 2, 2011: Oil Car Well (#51541), Buena Vista Well (#9788), and Muttleberry Well (#49006). Samples were analyzed by Sierra Environmental Monitoring, Inc. (metals, nutrients, ions) and Pace Analytical Services, Inc. (gross alpha and gross beta). Results of the groundwater samples show the following selected ranges:

- Total Dissolved Solids = 660 - 25,000 milligrams per liter (mg/L);
- pH = 7.39 - 8.25 standard units;
- Alkalinity = 110 - 160 mg/L;
- Sodium = 83 - 3,600 mg/L;
- Potassium = 3.4 - 64 mg/L;
- Chloride = 170 - 13,000 mg/L;
- Silica = 33 - 42 mg/L; and
- Sulfate = 110 - 1,500 mg/L.

The Oil Car and Muttleberry wells have similar water quality characteristics. The Buena Vista well has considerably higher concentrations of most non-metal analytes; this condition could be a result of influences from evaporites.

Several springs are located in the New York Canyon Project Area:

- Mustang Spring (NDWR #48439): owner = Estill; stock use; Sec. 25, SW-SE, T26N, R36E.
- Logan Spring near Logan Canyon (NDWR #9945): Sec. 4, SW-NW, T25N, R36E.
- Kitten Springs in Kitten Springs Canyon (NDWR #9949): Sec. 10, NW-NW, T25N, R36E.

- Spring near Big Ben Canyon: Sec. 1, SE-SE, T25N, R35E.
- Spring at head of New York Canyon (NDWR #9863): Sec. 11, SE-SE, T25N, R35E.
- Cabin Spring near Cornish Canyon (NDWR #10007): Sec. 22, NE-NE, T25N, R35E.
- Taylor Spring between Cornish and Hughes Canyons (NDWR #9781): Sec. 22, SW-SW, T25N, R35E.

According to the New York Canyon Geothermal Exploration Project EA (BLM 2010a), springs observed by field staff in the Project Area were cold, with other springs anticipated to also be non-thermal because of their location on the mountain flanks above the valley floor. Based on a review of US Geological Survey inventory information, no wells or springs are currently being monitored by the US Geological Survey in the New York Canyon Project Area (T25N R35E; T25N R36E; T26N R35E; and T26N R36E).

3.9. Wetlands/Riparian Zones

As mentioned in Section 3.8, Water Quality, there are no wetlands or riparian zones within the Project Area. As confirmed in Section 3.19, Vegetation, no wetland or riparian areas were identified either through the Southwest Regional GAP Analysis Project (SWReGAP) analysis or the ground surveys. As discussed in Section 3.8, Water Quality, several ephemeral channels and washes occur within the Project Area (EMPSi 2012). The nearest wetlands and riparian areas exist to the east of the Project Area, within the Lease Area, further up in the Stillwater Range.

3.10. Access and Transportation

The Lease Area is accessed at its northwestern edge via Dago Pass Road. Smaller, less developed roads allow access to other portions of the Lease Area. The public has unencumbered access to all portions of the Lease Area. The public has unencumbered access to the Stillwater Range through the Lease Area via existing roads.

Access to the Lease Area is predominantly via Interstate 80 for 13 miles along the paved Coal Canyon-Stillwater Road and then onto unpaved Dago Pass Road for a final 12 miles. Average Annual Daily Trips at Coal Canyon-Stillwater Road at the exit of Interstate 80 was 290 in 2011 (Nevada Department of Transportation 2013). Since the Coal Canyon Road exit is the primary access point to the Lovelock Correctional Facility, it is anticipated that the majority of these traffic counts are generated by that facility and that far lower traffic counts occur on the more rural aspects of Coal Canyon-Stillwater Road that would be used to access the Lease Area. Traffic counts along Dago Pass Road are unknown.

Alternative and less direct access routes to the Lease Area include Lovelock-Unionville Road, which can then access the Lease Area via (1) Buena Vista Valley Road to Dago Pass Road, or (2) Relief Canyon Road to Coal Canyon-Stillwater Road and finally onto Dago Pass Road.

Transportation along the project access routes are primarily for mining, ranching and dispersed recreation.

Off-highway vehicles currently have excellent access to the Lease Area due to multiple existing unmarked and unnamed dirt roads, trails, and cleared right-of-ways. Dago Pass Road crosses through approximately one mile of the northern portion of the Lease Area before exiting again to

the north. Kitten Springs Road enters the northern portion of the Lease Area and crosses through about 2.75 miles of the Lease Area before exiting to the east to become Fencemaker Pass Road. Ranching features including a well and windmill are present along Dago Pass Road within and adjacent to the Lease Area. A cleared area underneath a 60 kV electrical distribution line cuts through 4 miles of the central part of the Lease Area in an east-west direction. Slightly to the south, an additional cleared right-of-way for a buried fiber optic cable also crosses the Lease Area in an east-west direction for 5 miles. A dirt road crosses the southern portion of the Lease Area providing access to Cornish/Dave Canyon.

Portions of the airspace between Fallon and the Project Area is controlled by the US Navy. On occasion, the Navy restricts use of this airspace. TGP currently runs flights from Fallon to the TGP Dixie Power Plant using a flight path that runs from Fallon, northeast to Dixie Valley and then north along Dixie Valley.

3.11. Fire Management

Fire history data for the Project Area is available up until 2007. According to this data, no fires have occurred in the vicinity of the Project Area since 2000. The Project Area crosses four fire management unit types as follows:

- The Geothermal Development Area is within the "Veg – cheatgrass" and "Special Management Areas/Cultural" unit types.
- Proposed Action Gen-Tie Route crosses through the "Veg – cheatgrass" unit type in the Lease Area and again near the Oreana substation, the "High Value Habitat" unit type on the south edge of the Humboldt Range, and through the "Veg – Salt Shrub/Desert" unit type as it crosses through Buena Vista Valley.
- Alternative 1 Gen-Tie Route crosses through the "Veg – cheatgrass" unit type in the Lease Area and the "Veg – Salt Shrub/Desert" unit type as it crosses through Buena Vista Valley.

Pershing County Fire Department has the responsibility to respond to any structure fires or accidents within or along the Project Area. The BLM has the responsibility to respond to wildfires.

3.12. Lands and Realty

General land uses in the Project Area and vicinity include livestock grazing, mining, dispersed recreation and uses by Native American for pine nut gathering and related traditional practices.

Master title plats and mineral plats were reviewed for the Geothermal Development Area and for the gen-tie routes to identify other existing ROWs and interests that could possibly cause conflicts with the Proposed Action; results are summarized below. In general, ROWs were identified where they intersected or closely paralleled proposed gen-ties, and other land uses were noted where they occurred within 0.5 mile of any aspect of the Proposed Action or Alternative 1.

3.12.1. Geothermal Develpopment Area

Several ROWs or other authorizations have been granted on public lands within and adjacent to the Geothermal Development Area. These include ROWs for transmission and telephone lines (fiber optic), roads, pipelines, and geothermal leases. A BLM ROW exists just north of the

Geothermal Development Area for an existing paved road, in addition to a ROW for an existing transmission line owned by NV Energy (formerly Sierra Pacific Power) that runs east to west across the north end of the Project Area, running through T26N, R36E sections 25-30, and T26N, R35E sections 25-30. Just south of this lies a parallel ROW for both AT&T and Nevada Bell for an existing underground fiber optic line. These ROWs cross T26N R35E, sections 31-35 and T26N R36E, sections 28, 29, 31, 32, and 33 of the leased Project Area. In addition, a ROW owned by TGP Dixie Power Co. LLC has two segments located in two areas of the leased Project Area. This 12.5-foot wide road and pipeline ROW runs north to south in T26N R36E, sections 26 and 35; northeast to southwest in T26N R36E, sections 31 and 32 and continues in T25N R35E, sections 1, 2, 10, 11, and 15. Finally, a pipeline or conduit is located in T26N R36E, sections 26 and 32 of the leased Project Area.

3.12.2. Proposed Action

Traveling from the Oreana Substation down to the proposed power plant tie-line connection point, the gen-tie route would come within 0.5 miles of the following existing and proposed operations and intersect or parallel the following existing and proposed ROWs on BLM lands:

- Intersects a 50-foot wide power transmission line owned by Sierra Pacific Power Co (T28N R33E, section 4)
- Intersects access road Nev-059063 (T28N R33E, section 10)
- Passes within 0.05 miles of an improved spring (T28N R34E, section 31)
- Would intersect the proposed NV Iron ROW (at the corner point of four sections (T28N R33E, sections 25 and 36 and of T28N R34E, sections 30 and 31)
- Intersects a fence (T27N 34E, section 6)
- Intersects a 50-foot wide power transmission line Nev-065979 (T27N 34E, section 17 on private land and section 20 on BLM land) and also parallels and intersects this feature (section 32)
- Comes 0.23 mile within the Relief Canyon Mine project (specifically, 0.23 miles of the heap leach pad, T27N R34E, section 18)
- Would intersect the proposed access road for the Relief Canyon Mine project (T27N R34E, section 17)
- Travels through a cluster of abandoned mines (shafts and adits) (T27N R34E, section 32)

3.12.3. Alternative 1

The proposed alternative power plant tie line route would not parallel or intersect any existing ROWs or come within 0.5 miles of existing operations on BLM lands.

3.13. Noise

Noise is defined as unwanted sound and can be intermittent or continuous, steady or impulsive. Human response to noise is extremely diverse and varies according to the type of noise source,

the sensitivity and expectations of the receptor, the time of day, and the distance between the noise source and the receptor.

The decibel (dB) is the accepted unit of measurement for noise. Because human hearing is not equally sensitive to all sound frequencies, various frequency weighting schemes have been developed to approximate the way people hear sound. The A-weighted decibel scale (dBA) is normally used to approximate human hearing response to sound. Example sound noise levels are as follows:

- Audiometric testing booth is 10 dB (barely audible);
- Quiet rural nighttime is 10 to 20 dB;
- Rural daytime outdoors is 45 dB;
- Quiet urban daytime is 50 dB;
- Normal conversation is 55 dB;
- Automobile at 100 feet is 60 dB;
- Leaf blower at 50 feet is 70 dB;
- Bulldozer at 50 feet is 85 dB;
- Jackhammer at 50 feet is 90 dB;
- Commercial fireworks at 1,500 feet are 115 dBA.

Relative to human receptors, noise levels under 45 dBA are considered quiet, 46 to 65 dBA are considered moderately loud, 66 to 75 dBA are considered loud, 66 to 110 dBA are considered very loud and 111 dB and above are considered uncomfortable.

LAeq refers to the “equivalent” average sound level. During daytime, few people are highly annoyed at LAeq levels below 55 dBA, and few are moderately annoyed at LAeq levels below 50 dBA (World Health Organization 1999); however, in quiet rural settings, noise levels well below 50 dBA could be considered annoying (Leitner undated).

To avoid annoyance and interference with normal human activity, sound levels during the evening and night are recommended to be 5 to 10 dB lower than during the day. Indoor guideline values for bedrooms are 30 dBA LAeq for continuous noise and 45 dBA as the maximum for single sound events. Lower noise levels may be disturbing depending on the nature of the noise source. At nighttime, outside sound levels about 3 feet from the exterior of living spaces are recommended to not exceed 45 dBA LAeq, so that people may sleep with bedroom windows open. This value was obtained by assuming that the noise reduction from outside to inside with the window open is 15 dBA (World Health Organization 1999).

3.13.1. Applicable Noise Regulations

The federal Geothermal Resources Operational Order Number 4 mandates that noise levels must be 65 dBA or less at the geothermal lease boundary or 0.5 mile from the source, whichever is greater. Pershing County does not have a noise ordinance and does not specify acceptable noise limits.

3.13.2. Past Citizen Response to Geothermal-Related Noise

Citizen noise complaints from geothermal development operations at The Geysers geothermal field in California have been analyzed by the Lake County Air Pollution Control District and by Long/Davy/Associates for the Noise Element of Lake County General Plan. They found that most community annoyance is related to noise from steam venting, well drilling, and truck traffic. Community response appears to follow fairly well a typical curve between the severity of public reaction and the magnitude of the outdoor day/night average sound level. The most common complaints are in response to receptor sound-pressure levels of 60 to 70 dBA or higher; however, in some cases, levels as low as 40 to 55 dBA have drawn a more frequent response than would be expected in a typical urban or suburban community. It is not clear whether such complaints are related to the low ambient noise levels of the region or to nonacoustic factors, such as opposition to geothermal development in general (Leitner 1978).

3.13.3. Project Area Overview

The Geothermal Development Area, within the Lease Area, is a rural environment whose natural soundscape includes wind, weather and wildlife, the sounds of traffic, dispersed recreation, and intermittent ranching-related vehicle and equipment traffic. Several military flight paths cross over the Lease Area and the southern two-thirds of the Lease Area are within a Military Special Use Area. Military Training Route, or Instrument Route 281, overlies the Geothermal Development Area. Instrument Route 281 is currently inactive but but is proposed by the US Air Force to resume. During usage of the airspace for military training over or near the Project Area, it is assumed that aircraft overshadowed all other components of the area soundscape. Portions of the Proposed Action gen-tie route pass through or near active mining operations. These portions of the Project Area experience elevated background noise levels due to the mining activities and associated heavy truck traffic.

While ambient sound levels for wilderness and rural areas typically range between 30 and 40 dBA (EPA 1978), some areas are likely louder due to mining, although no measurements are available.

Sensitive noise receptors are generally considered to be homes, hospitals, schools, libraries, and churches. None of these typical sensitive noise receptors are present within the vicinity of the Project Area; however, Native American traditional use sites are present in the Stillwater Range to the east of the Geothermal Development Area. Wildlife is also considered to be a sensitive noise receptor, depending on the species present in the Project Area.

3.14. Paleontological Resources

An Initial Paleontological Resources Assessment for the original exploration Lease Area was completed by Dr. Geof Spaulding and submitted to the BLM on November 18, 2009 (Spaulding 2009). The assessment includes Potential Fossil Yield Classification (PFYC) of the geological units affected by the Proposed Action based on the results of literature searches and records reviews, as well as an analysis of remote imagery of the original exploration Project Area. Lease stipulations designate portions of the Lease Area as possessing a PFYC of 3a, or moderate potential. IM-2008-009 states, “If a Class 3a (Moderate Potential) unit underlies the area, the local geologic conditions should be considered, as well as any known localities in the region. It may be necessary to consult with…[a] qualified paleontologist to assess the local conditions.”

After assessing the local conditions of the Project Area, including a lack of fossil records and lack of sediment types known to consistently yield fossils, Dr. Spaulding, a qualified paleontologist, concluded that the entire Project Area can be assigned a PFYC of 2 (Spaulding 2009). Sedimentary units that possess low sensitivity are not likely to contain scientifically significant fossils. The assessment concluded that a paleontological field survey of the original Lease Area was not necessary due to the absence of sediments with unknown or high paleontological sensitivity (PFYC $\geq$ 3).

The exploration Lease Area is located on the upper bajada of the Stillwater Range immediately below (to the north and west) the piedmont. The coarse Quaternary alluvium and fanglomerate that typifies the substrate of the upper bajada of the Stillwater Range, and most Great Basin mountain ranges, typically contains no fossil remains because the environment of deposition is not conducive to fossil preservation. High-energy landslides and floods that contribute to the build-up of alluvial fans are apt to mechanically degrade organic remains, and surviving material would be left on or near the surface in an oxidizing environment where it would soon decompose. As a consequence, fossils are not found in the proximal portions of the alluvial fans of Great Basin mountain ranges. However, this is not always the case for the toes, or distal portions, of alluvial fans where they can interlace with lacustrine (lake) or fluvial (river) environments. In such cases, fine-grained strata laid down quickly in anoxic (oxygen poor) sedimentary environments can yield excellently preserved fossils. Review of available remote imagery indicates that these lower bajada environments lie two to four miles north of the Lease Area, near the bottom of the Buena Vista Valley.

Since the above assessment was conducted for the exploration phase of the project, TGP acquired additional leases to the north of the original Lease Area. The new Lease Area covers an area extending 1.3 to 2.0 miles north of the original Lease Area. Extrapolation of the above assessment indicates that the northern edge of the current Lease Area could be considered to be within the lower bajada and therefore could contain fossilized flora and fauna. Additionally, the gen-tie routes span an array of soil types and geologic units, some of which may have high potential to contain fossilized flora and fauna.

In December 2012 and January 2013, Applied EarthWorks Inc., produced a paleontological monitoring plan to address PFYC 4 lands along the Proposed Action gen-tie route. This report is included as Appendix C (*Appendices are available for download from the project website under "Documents"*).. The area of focus was based on BLM's data of PFYCs. No PFYCs of 4 or higher were present along the Alternative 1 gen-tie route.

3.15. Range Resources

BLM manages livestock grazing on public rangelands in accordance with the CFR Part 4100 and various BLM Manuals. Public lands designated and managed for livestock grazing are divided into allotments. These allotments are grazed by livestock owned by a rancher (permittee) who controls a base property (ranch) with an attached BLM grazing preference. Grazing Preference is the number of Animal Unit Months (AUMs) attached to a specific base property. An AUM is the amount of forage needed to sustain one cow (with calf), five sheep, or five goats for a month. Stock ponds exist within the Lease Area.

The Project Area overlaps with four allotments as shown in Table 3.4, Allotment Acreage Associated with Each Portion of the Project Area and in Figure 13, BLM Grazing Allotments.

Table 3.4. Allotment Acreage Associated with Each Portion of the Project Area

Allotment Name	Geothermal Development Area	Proposed Action Gen-Tie Route	Alternative 1 Gen-Tie Route	Total Acreage in Study Area	Total Allotment Acreages
Coal Canyon-Poker		205		205	97,828
Rochester	7762	439	231	8432	431,784
Rawhide			326	326	153,597
Star Peak			42	42	81,356
Source: BLM 2012, EMPSi 2012					

The Geothermal Development Area lies within the Rochester Allotment, which comprises 431,784 acres (BLM 2012). The allotment consists primarily of public and private lands in a "checkerboard" (alternating sections) pattern with small portions of US Bureau of Reclamation and US Department of Defense property in the southern corner of the allotment. The majority of the public lands are administered by the BLM Winnemucca District Office.

The Proposed Action Gen-Tie Route would extend into the Coal Canyon-Poker Allotment, and the Alternative 1 Gen-Tie Route would extend into the Rawhide and Star Peak allotments. The total acreages of each of these allotments are shown in Table 3.4, Allotment Acreage Associated with Each Portion of the Project Area.

3.16. Social and Economic Values

As the crow flies, the Lease Area is approximately 55 linear miles northeast of Fallon and 25 linear miles east of Lovelock (see Figure 1). By road, the Lease Area is approximately 32 miles or a one hour drive from Lovelock. Fallon is an extra 56 miles and a one hour drive from Lovelock making for an approximate two-hour one-way commute. The Proposed Action would be located in a geographically remote and undeveloped area without any existing communities or dispersed population. The region is characterized by ranching and livestock grazing, dispersed recreation and Native American traditional uses. The closest population centers are Fallon, in Churchill County, and Lovelock, in Pershing County. The closest ranch with a residence is approximately 21 miles north of the Lease Area.

3.16.1. The Gen-Tie Lines

The Proposed Action Gen-Tie Line would run west from the Lease Area to the Oreana substation located approximately 2.25 miles east of Interstate 80 and 0.6 miles North of Lovelock-Unionville Road. The line would be located in a remote area that is undeveloped other than for the Coeur Rochester Mine. The closest ranch with a residence is approximately 12 miles northeast of the Proposed Action Gen-Tie line.

Alternative 1 Gen-Tie Line would run north from the Lease Area through Buena Vista Valley to connect to an existing power line. The northern terminus of the Alternative 1 Gen-Tie Line, and the substation that would be constructed there, would be approximately 5.5 miles from Unionville, Nevada. The area around the Alternative 1 Gen-Tie Line is relatively undeveloped and geographically remote with use generally limited to dispersed recreation and agriculture.

3.16.2. Social and Economic Values

The Social and Economic Study Area includes Pershing and Churchill counties since the Proposed Action is located on border of the two counties and workers and services may come from either county. Pershing County is located in northwest central Nevada and encompasses 6,068 square miles. The county is bordered by Humboldt, Lander, Churchill, and Washoe counties to the north, east, south, and west, respectively. Interstate 80 runs north-south through the county. Table 3.5, Socioeconomic Characteristics of the Study Area, outlines some of the key social and economic characteristics of the county, including population, housing, labor, and income.

The total population of Pershing County in 2010 was estimated to be 6,753, which was an increase of 0.9 percent since 2000 (population 6,693) (US Census 2010a). The population density as of 2010 was 1.1 persons per square mile, compared to 24.6 for Nevada and 87.4 for the United States (US Census 2010a). The population of Lovelock, the county's largest city and county seat, was estimated to be 1,894, which was a decrease of 5 percent since 2000 (population 2,003) (US Census 2010a). Lovelock is close to many rural mining operations and is home to numerous restaurants, retail outlets, lodging accommodations, and a Nevada State correctional facility. Unionville is also located within Pershing County, a ghost town and tourist attraction made famous for its quick rise and fall in prominence during a silver rush in the late 1800s. Unionville has one bed-and-breakfast lodging facility.

Table 3.5. Socioeconomic Characteristics of the Study Area

Region	Total Population (2010)	Housing[1]			Labor			
		Housing Units	Occupied (%)	Median Value of Owner-Occupied ($)[2]	Labor Force (2011)[4]	Largest Employment Sectors (2010)[3]	2011 Annual Unemployment Rate (%)[4]	Per Capita Personal Income (2010)[3]
Pershing County	6,753	2,464	81.9	134,500	2,775	Government - state, local, federal, military (32.5%) Mining (16.2%) Farm Employment (10.1%) Retail Trade (8.6%)	11.7	$23,735
City of Lovelock	1,894	945	81.3	118,500	--	--	--	--

Churchill County	24,877	10,826	89.3	188,300	13,426	Government - state, local, federal, military (12.8%) Real Estate, rental, and leasing (11.9%) Finance and Insurance (10.4%) Retail Trade (8.8%)	11.0	$40,581
City of Fallon	8,606	3,979	88.3	158,900	--	--	--	--

Sources:

1. US Census Bureau 2010a
2. US Census Bureau 2010b
3. Bureau of Economic Analysis 2010
4. Bureau of Labor Statistics 2011

The economy of Pershing County is based on several major industries, including mining, agriculture, retail trade, and tourism, with the top employers in the county being Nevada Department of Corrections and various silver and gold mining corporations (Nevada Workforce 2011). The median household income for Pershing County is $56,491 annually (US Census 2010b), with an unemployment rate of 11.7 percent in 2011 (1.8 percent lower than the statewide unemployment rate of 13.5 percent) (Bureau of Labor Statistics 2011).

Churchill County is adjacent and south of Pershing County, encompassing 5,023 square miles. It is bordered by Lander (east), Nye (southeast), Mineral (south), Carson City (southwest), and Washoe (west) counties. US Highway 50 runs east-west through the county. Table 3.5 outlines some of the key social and economic characteristics of the county, including population, housing, labor, and income.

The total population of Churchill County in 2010 was estimated to be 24,877, which was an increase of 3.7 percent since 2000 (population 23,982) (US Census, 2010a). The population density as of 2010 was 5.0 persons per square mile (US Census 2010a). The population of Fallon, the county's largest city and county seat, was estimated to be 8,609, which was an increase of 3 percent since 2000 (population 8,386) (NV County Certified Population Estimates 2011). Fallon is also home to numerous restaurants, casinos, and retail outlets, and provides a variety of lodging and recreational opportunities in the surrounding area. Six miles southeast of Fallon is the Naval Air Station Fallon.

The economy of Churchill County is based on government services, accommodation and food services, education and healthcare, and retail trade, with a median household income of $51,597

annually (US Census 2010b). The unemployment rate in Churchill County is 11.0 percent in 2011, 2.5 percent lower than the statewide rate of 13.5 percent (Bureau of Labor Statistics 2011).

Data from 2010 showed housing vacancy rates of approximately 18.7 percent in Lovelock, with 177 housing units vacant out of 945, and a rental vacancy rate of 20.8 percent. Fallon had a housing vacancy rate of 11.7 percent, with 464 housing units vacant out of 3,979, and a rental vacancy rate of 11.1 percent (US Census 2010a). Fallon has eleven motels and four RV parks, which could also provide temporary housing (Fallon Convention and Tourism Authority 2012); Lovelock has seven motels and one RV park (City of Lovelock Nevada 2012).

The Lease Area is located within the Rochester Livestock Grazing Allotment, which comprises 254,755 acres. The Proposed Action Gen-Tie Route is within the Coal Canyon-Poker Grazing Allotment, and the Alternative 1 Gen-Tie Route passes through the Rawhide and Star Peak grazing allotments. There are no developed recreational areas within or near the Project Area.

3.16.3. Environmental Justice

On February 11, 1994, President Clinton signed Executive Order 12898, requiring all federal agencies to seek to achieve environmental justice by "…identifying and addressing effects of its programs, policies, and activities on minority and low-income populations." This section provides an overview of minority and low-income populations in the New York Canyon Geothermal Utilization and Interconnect Area, including the cities of Lovelock and Fallon as well as Pershing and Churchill counties in Nevada.

The Council on Environmental Quality defines minority as individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic (Council on Environmental Quality 1997). t. Minority population characteristics for Lovelock, Fallon, Pershing County, and Churchill County are outlined in Table 3.6, Population Characteristics by Race and Ethnicity. The 2010 Census identified the white population as being over 75 percent of the entire population in each of the cities and counties within proximity to the Project Area. In the context of analyzing the proposed project for potential effects on minorities, any area containing a minority population greater than 50 percent of the total population, or containing a minority population meaningfully greater than the minority population in Churchill or Pershing counties, would be identified as a minority population within the Project Area. The Project Area is in a remote undeveloped region. While there are no tribal lands located within or adjacent to the Project Area, the population proportion for the American Indian and Alaska Native population in the study area was relatively higher than the state as a whole. BLM has conducted consultations with the tribes. Local tribal concerns are addressed in Section 3.5 and Section 4.1.5, Native American Religious Concerns.

Table 3.6. Population Characteristics by Race and Ethnicity

Reporting Group	Lovelock	Pershing County	Fallon	Churchill County	State of Nevada
White[1]	75.8%	81.9%	78.9%	82.0%	66.2%
Black or African American[1]	0.3%	3.7%	2.8%	1.6%	8.1%
American Indian and Alaska Native[1]	7.9%	3.2%	2.9%	4.5%	1.2%
Asian[1]	1.4%	1.3%	4.5%	2.7%	7.2%

Native Hawaiian and Other Pacific Islander[1]	0.4%	0.1%	0.2%	0.2%	0.6%
Persons Reporting some other race[1]	8.7%	6.7%	4.9%	4.8%	12.0%
Persons Reporting two or more Races	5.5%	3.1%	5.8%	4.2%	4.7%
Hispanic or Latino (of any race)[2]	25.3%	22.3%	12.8%	12.1%	26.5%

Source: US Census Bureau 2010b

1. Includes persons reporting only one race

2. Hispanics may be of any race so also are included in applicable race categories.

For Pershing County, the median household income in 2010 was $56,491 and 13.7 percent of people lived below the poverty line. For the city of Lovelock, the median household income was $38,250 and 25.1 percent of people lived below the poverty line. The median household income for Churchill County was $51,597 and 8.8 percent of people lived below the poverty line, while the median household income for Fallon was $47,646 and 10.5 percent of people lived below the poverty line. For the state of Nevada, the median household income and poverty rate for 2010 was $55,726 and 11.9 percent, respectively (US Census 2010b). The median household income and poverty rates for Pershing County, Churchill County, and Fallon are comparable to those for the state as a whole, the income levels for Lovelock are substantially lower, which may contribute to the high poverty level in this city.

3.17. Soils

Table 3.7, Acres of Soils Types Occurring in Project Area, and Figure 14, Soil Orders show the soil types occurring within the Project Area as identified using GIS data downloaded from the Natural Resources Conservation Service. The Geothermal Development Area is defined as the total acreage that was cleared for cultural resources and forms the area of potential impact for the power plant, pipelines, access roads, and air field. The gen-tie route areas were the 200 foot corridor that was surveyed for cultural resources for each route. This table, together with Figure 15, Farmland Classifications shows the areas and acreages of farmland classifications within the and around the Project Area.

Table 3.7. Acres of Soils Types Occurring in Project Area

Soil Type	Project Component		
	Geothermal Development Area	Proposed Action Gen-Tie Route	Alternative 1 Gen-Tie Route
Farmland of Statewide Importance	0	13	314
Prime Farmland if Irrigated and Reclaimed of Excess Salts and Sodium	0	1	0
Chilper_Trocken-Jerval association	2600	31	2
Jerval-Knoss-Chilper association	1400	0	
Mazuma-Swingler-Trocken association	3500	168	171

Theon-Singatse association	300	68	0
Atlow-Wiskan association	0	0	0
Jobpeak- Teguro-Rock outcrop association	0	0	0
Kram-hopeka-Rock outcrop association	0	0	0
Puffer-Mulhop-Rock outcrop association	0	0	0
Trocken-Bluewing association	0	0	17
Whirlo-Beoska-Oxcorel association	0	0	69
Hawsley-Ragtown association	0	15	16
Jerval-Chilper-Bluewing association	0	0	55
Jerval-Trocken-Golconda association	0	0	158
Playas	0	21	23
Trocken gravelly very fine sandy loam, 2 to 8 percent slopes	0	13	87
Bliss-Chiara association, sloping	0	39	0
Bubus very fine sandy loam, 0 to 2 percent slopes	0	3	0
Eastwell-Shabliss-Blackhawk association	0	28	0
Hoot, steep-Bojo-Hoot association	0	60	0
Mazuma very fine sandy loam, 2 to 8 percent slopes	0	22	0
Oxcorel-Beoska association	0	31	0
Puffer, very steep-Atlow-Puffer association	0	34	0
Snapp-Oxcorel association	0	56	0
Trunk-Burrita association	0	53	0
Weso very fine sandy loam, 0 to 2 percent slopes	0	1	0
Slaw-Trocken-Chuckles association	0	0	0
Bluewing-Pineval association	0	0	0
Total = 9,369 acres	**7,800**	**657**	**912**
Source: USDA NRCS 2012			

Roughly 43 percent of the Project Area would be located on soil unit 983 Mazuma-Swingler-Trocken association. This soil is associated with lake plains and is slightly-to-strongly saline and is composed of silt loam or sandy loam. These soils have a slight hazard of off-road or off-trail erosion and are well to moderately suited for natural surface road construction (USDA NRCS 2009).

Roughly 31 percent of the Project Area would be located within soil unit 691 (Chilper-Trocken-Jerval association). Roughly 17 percent would be located within soil unit 132 (Jerval-Knoss-Chilper association). Both of these soil units occur on fan piedmonts between

4,000 to 5,000 feet. The soils generally occur on 2 to 8 percent slopes, are well drained, never flood or pond, and are slightly-to-strongly saline. The upper soils are generally composed of cobbly or gravelly sandy loam or clay loam. Areas with Chilper soils may occur on 30 to 50 percent slopes. Most of the soils in units 691 and 132 have a slight hazard of off-road or off-trail erosion and are well to moderately suited for natural surface road construction. Some areas with Knoss or Chilper soils may be poorly suited for natural surface road construction due to sandiness, low strength, and slope (USDA NRCS 2009).

Fourteen acres of soils with a farmland designation occur within the Proposed Action Gen-Tie Route portion of the Project Area. The Alternative 1 Gen-Tie Route portion of the Project Area overlies 314 acres of soils with a farmland designation.

3.18. Special Status Species

3.18.1. Regulatory Background

3.18.1.1. Endangered Species Act

The Endangered Species Act of 1973 (16 USC §§1531 *et seq*.), as amended, provides for the conservation of federally listed plant and animal species and their habitats. The Endangered Species Act directs federal agencies to conserve listed species and imposes an affirmative duty on these agencies to ensure that their actions are not likely to jeopardize the continued existence of a listed species or adversely modify its designated critical habitat.

Critical habitat is defined in the Endangered Species Act as:

the specific areas within the geographical area occupied by the species ... on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and ... specific areas outside the geographical area occupied by the species ... upon a determination by the Secretary [of the Interior] that such areas are essential for the conservation of the species. [16 USC 1532(5)(A)]

3.18.1.2. BLM Manual 6840 — Special Status Species Management

BLM Manual 6840 provides management policy for federally listed species and BLM-designated sensitive species. Species classified as BLM-designated sensitive must be 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:

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 protects and manages habitat for the enhancement and protection of the species future existence.

3.18.1.3. Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (1940, as amended 1959, 1962, 1972, 1978) prohibits the take or possession of bald and golden eagles with limited exceptions. Take, as defined in the Act, includes "to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." 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, injury to an eagle; a decrease in its productivity by substantially interfering with normal breeding, feeding or sheltering behavior; or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior. An important eagle-use area is defined in the Act 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 that are essential for the continued viability of the site for breeding, feeding, or sheltering eagles.

The BLM requires consideration and NEPA analysis of golden eagles and their habitat for all renewable energy projects (BLM IM No. 2010-156). The BLM IM on Golden Eagles provides direction for complying with the Act, including its implementing regulations (i.e., Eagle Rule, 50 CFR parts 13 and 22) for golden eagles, and to identify steps that may be necessary within the habitat of golden eagles to ensure environmentally responsible authorization and development of renewable energy resources (BLM 2010b). The IM primarily addresses golden eagles, because a process to acquire take permits for bald eagles already exists. The IM is applicable until the USFWS establishes criteria for programmatic golden eagle permits.

3.18.2. Methods

Information regarding special status species within the Project Area is based on the results of biological studies conducted in support of the project between 2009 and 2011 (CH2M HILL 2009, EMPSi 2012). Methods are similar to those described in Section 3.19, Vegetation. In addition, EMPSi reviewed the BLM sensitive species list, provided by the Winnemucca District Office biologist, and their habitat requirements. In addition, EMPSi requested lists of threatened, endangered, and sensitive species from the NNHP (NNHP 2011), Nevada Department of Wildlife (Nevada Department of Wildlife 2011), and the USFWS (USFWS 2011).

3.18.2.1. Ground Survey

Biological resource surveys were conducted, and existing information was reviewed, as described in Section 3.19, Vegetation. All ground burrows within project footprints and buffers were noted and examined for evidence of burrowing owls (e.g., feathers, pellets with insect exoskeletons, whitewash).

3.18.2.2. Golden Eagle Aerial Survey

During initial correspondence, the USFWS recommended an aerial survey for nesting golden eagles (*Aquila chrysaetos*) within four miles of each transmission line route due to the potential for effects on golden eagles nesting within and near the Project Area.

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 helicopter. The surveys

included a four-mile buffer on either side of the two gen-tie options and were conducted over three days: June 27, 28, and 29, 2011.

Rocky outcrops, areas of suitable raptor nest trees, and structures (e.g., transmission lines) were flown and examined for nest structures. Nests were discerned as inactive, active, or occupied. Inactive nests are those nests without whitewash (or showing very little), or other evidence of attendance (e.g., greenery). Active nests are those nests showing whitewash, and occupied nests are those surveyed with young golden eagles in them. In addition, data was shared with a nearby project where overlap occurred in the southern portion of the Humboldt Range. The shared data revealed one recorded active nest as being occupied during surveys in early June (Pondera Ecological Consulting 2011).

3.18.2.3. Bat Survey

In 2000 and 2012, cold-season bat surveys associated with the Coeur Rochester Mine were conducted within the Project Area. These surveys identified caves and adits that included hibernation roosts. Results from the 2000 and 2012 cold-season surveys showed seven hibernation locations that are within 200 yards of the Proposed Action Gen-Tie survey corridor. These data were overlaid on the New York Canyon Project Area to determine the proximity of hibernation roosts to the project.

3.18.3. Regional Overview

No federally listed endangered or threatened species occur within the Project Area (USFWS 2011). In addition, no critical habitat for any federally endangered or threatened species has been designated within the Project Area. However, based on the variety of habitats observed, numerous BLM sensitive species and other special status species have the potential to occur within the Project Area (Table 3.8, BLM Sensitive Species and Other Special Status Species Potentially Occurring Within the Project Area). One special status mammal (bighorn sheep), three special status plants (sand cholla [*Grusonia pulchella* syn. *Opuntia pulchella*], Lahontan milkvetch [*Astragalus porrectus*], and Lahontan beardtongue) and three special status birds (juniper titmouse [*Baeolophus ridgwayi*], prairie falcon [*Falco mexicanus*], and pinyon jay [*Gymnorhinus cyanocephalus*]) were observed during field surveys (EMPSi 2012; CH2M Hill 2009).

3.18.4. Geothermal Development Area

Mines and caves of the Stillwater Range provide roosting habitat for bat species, but potential roosting habitat is not found in the Geothermal Development Area. Several BLM-sensitive bat species such as western pipistrelle (*Pipistrellus hesperus*), pallid bat (*Antrozous pallidus*), and various myotis species, may use the Lease Area for foraging.

The Lease Area provides potential suitable habitat for BLM-sensitive avian species that use open desert habitats, including golden eagle, burrowing owls (*Athene cunicularia*), loggerhead shrike (*Lanius ludovicianus*), and gray vireo (*Vireo vicinior*). A ferruginous hawk was observed during the field survey. Prairie falcons may be found in the cliff habitats of the Stillwater Range.

Table 3.8. BLM Sensitive Species and Other Special Status Species Potentially Occurring Within the Project Area

Species	Habitat	Potential for Occurrence		
		Geothermal Development Area	Gen-tie	
			Proposed Action	Alternative 1
Plants				
Sand cholla *Opuntia pulchella*	Sand of dunes, dry-lake borders, river bottoms, washes, valleys, and plains in the desert between 4,000 and 6,200 feet elevation.	Potential to occur.	Potential to occur.	Potential to occur.
Lahontan beardtongue *Penstemon 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 to occur.	Potential to occur.	Potential to occur.
Lahontan milkvetch [1] *Astragalus porrectus*	Open washes, alluvium, or gullies in the shadscale zone.	Potential to occur.	Confirmed.	Potential to occur.
Reese River phacelia [1] Phacelia glaberrima	Open, steep slopes of low hills, bluffs, and badlands in the shadscale-greasewood, sagebrush, and lower pinyon-juniper zones.	Potential to occur.	Potential to occur.	Potential to occur.
Invertebrates				
Great Basin small blue *Philotiella speciosa septentrionalis*	Shrubby desert. Host plant is buckwheat, *Oxytheca*.	Potential to occur	Potential to occur	Potential to occur
Birds				
Brewer's sparrow *Spizella breweri*	Sagebrush, greasewood, perennial upland grasslands.	Potential to occur.	Potential to occur.	Potential to occur.
Burrowing owl *Athene cunicularia*	Treeless areas with low vegetation and burrows.	Potential to occur.	Potential to occur.	Potential to occur.
Greater sage-grouse *Centrocercus urophasianus*	Sagebrush, montane shrubland, wet meadow.	Potential to occur.	Potential to occur.	Potential to occur.
Golden eagle *Aquila chrysaetos*	Variety of open and semi-open landscapes with sufficient mammalian prey base and cliff sites for nesting.	Potential to occur.	Confirmed.	Confirmed.

Ferruginous hawk *Buteo regalis*	Grasslands and semidesert shrublands; nest in isolated trees, on rock outcrops, or ground.	Confirmed.	Potential to occur.	Potential to occur.
Sage thrasher *Oreoscoptes montanus*	Sagebrush, greasewood, various salt desert or montane shrub species.	Potential to occur.	Potential to occur	Potential to occur
Swainson's hawk *Buteo swainsoni*	Usually occurs close to riparian or other wet habitats; forages over agricultural fields, wet meadows, or open shrublands.	Potential to occur.	Potential to occur.	Potential to occur.
Pinyon jay *Gymnorhinus cyanocephalus*	Pinyon pine, juniper, sagebrush, occasionally ponderosa or Jeffrey pine.	Potential to occur.	Potential to occur.	Potential to occur.
Loggerhead shrike *Lanius ludovicianus*	Open country with scattered trees and shrubs, desert scrub. Nests in shrubs or small trees.	Potential to occur.	Confirmed.	Potential to occur.
Mammals				
Pygmy rabbit *Brachylagus idahoensis*	Tall, dense sagebrush with deep, loose soils.	Unlikely to occur.	Unlikely to occur.	Unlikely to occur.
Townsend's big-eared bat *Corynorhinus townsendii*	Maternity and hibernation colonies typically in caves and mine tunnels.	Potential foraging habitat.	Potential foraging habitat.	Potential foraging habitat.
Spotted bat *Euderma maculatum*	Various habitats from desert to montane. Roosts in caves and crevices in cliffs and canyons.	Potential foraging habitat.	Potential foraging habitat.	Potential foraging habitat.
Small-footed myotis *Myotis ciliolabrum*	Desert, badland, and semi-arid habitats. Roosts in rock crevices, caves, and buildings.	Potential foraging habitat.	Potential foraging habitat.	Potential foraging habitat.
Long-eared myotis *Myotis evotis*	Mostly forested areas; also shrubland, along wooded streams, over reservoirs. Roosts in buildings, hollow trees, mines, and caves.	Potential foraging habitat.	Potential foraging habitat.	Potential foraging habitat.
Fringed myotis *Myotis thysanodes*	Desert, grassland, and wooded habitats. Roosts in caves, mines, rock crevices, and buildings.	Potential foraging habitat.	Potential foraging habitat.	Potential foraging habitat.

Long-legged myotis *Myotis volans*	Primarily in montane coniferous forests; also in riparian and desert habitats. Roosts in abandoned buildings, and rock crevices.	Potential foraging habitat.	Potential foraging habitat.	Potential foraging habitat.
Western pipistrelle *Pipistrellus hesperus*	Desert mountain ranges and scrub flats and rocky canyons.	Potential foraging habitat.	Potential foraging habitat.	Potential foraging habitat.
Pallid bat *Antrozous pallidus*	Arid deserts and grasslands, often near rocky outcrops and water. Roosts in rock crevice or building.	Potential foraging habitat.	Potential foraging habitat.	Potential foraging habitat.
Silver-haired bat *Lasionycteris noctivagans*	Prefers forested areas adjacent to lakes, ponds, and streams. Roosts in trees and buildings.	Potential foraging habitat.	Potential foraging habitat.	Potential foraging habitat.
Desert bighorn sheep *Ovis canadensis nelsoni*	Steep slopes on or near mountains with a clear view of surrounding area.	Potential to occur. Suitable habitat within the Stillwater Range.	Potential foraging habitat.	Potential foraging habitat.
Big brown bat *Eptesicus fuscus*	Various wooded and semi-open habitats including cities. Roosts in buildings, trees, rock crevices, and caves.	Potential foraging habitat.	Potential foraging habitat.	Potential foraging habitat.
Hoary bat *Lasiurus cinereus*	Prefers deciduous and coniferous forests and woodlands. Roosts in tree and rock crevices.	Potential foraging habitat.	Potential foraging habitat.	Potential foraging habitat.
California myotis *Myotis californicus*	Western lowlands; roosts in man-made structures, crevices, on small desert shrubs or on the ground.	Potential foraging and roosting habitat.	Potential foraging and roosting habitat.	Potential foraging and roosting habitat.
Little brown myotis *Myotis lucifugus*	Adapted to using human-made structures. Also uses caves and hollow trees.	Potential foraging habitat.	Potential foraging habitat.	Potential foraging habitat.
Brazilian free-tailed bat *Tadarida braziliensis*	Roosts primarily in caves.	Potential foraging habitat.	Potential foraging habitat.	Potential foraging habitat.
Sources: CH2M HILL 2010; Great Basin Bird Observatory 2010; NatureServe 2011; Wildlife Action Plan Team 2006; NNHP 2011; Morefield 2001 1. Not a BLM sensitive species. Considered at-risk by the NNHP.				

Desert bighorn sheep use steep slopes on or near mountains with a clear view of surrounding areas. Bighorn sheep are present in the Stillwater Range.

Although sagebrush habitats are found along the slopes of the Stillwater Range and low value sage-grouse habitat is found along the southern border of the Lease Area, the remainder of the

Lease Area does not provide suitable habitat for either pygmy rabbits (*Brachylagus idahoensis*) or greater sage-grouse (*Centrocercus urophasianus*). Pygmy rabbits typically burrow in dense stands of big sagebrush growing in deep loose soils (NatureServe 2009). Sagebrush habitats in the Lease Area are patchy and mixed with other shrubs such as greasewood, rabbitbrush, curl-leaf mountain mahogany, and Nevada jointfir and do not contain large areas of tall, dense sagebrush that would constitute potential pygmy rabbit habitat.

Greater sage-grouse depend on a wide variety of sagebrush mosaic habitats (NatureServe 2009), are found in foothills, plains, and mountain slopes where sagebrush is present and use a mixture of sagebrush, meadows, and aspen habitats in close proximity to each other. Low value Greater Sage-grouse habitat exists at the southern edge of the Lease Area, which is four miles to the south of the Project Area. No other sagebrush habitat is known or mapped within the Lease Area (EMPSi 2013). The nearest Sage-grouse winter, summer, nesting, and early brood-rearing habitats, as well as the Stillwater PMU can all be found just beyond the southern edge of the Lease Area, approximately four miles south of the Geothermal Development Area portion of the Project Area. No pygmy rabbit or sage grouse habitat or sign were observed during the field survey.

Due to the presence of suitable habitat, golden eagles have the potential to occur within the Geothermal Development Area. None were observed in this area during the 2011 Golden Eagle Survey (Pondera Ecological Consulting 2011).

3.18.5. Proposed Action Gen-Tie Route Project Area

During the field surveys, two NNHP special status plant species, Lahontan milkvetch and Lahontan penstemon, were observed along the proposed gen-tie route. A loggerhead shrike, which is a BLM-sensitive bird species, was also observed along the proposed gen-tie route (Table 3.8). In addition, a burrowing owl burrow has been recorded within one mile of the proposed gen-tie route. According to the Nevada Department of Wildlife, there is potential bighorn sheep habitat for eight to ten miles of the proposed gen-tie route.

As shown in Figure 16, Preliminary Greater Sage-Grouse Habitat, Sage-grouse Preliminary General Habitat can be found approximately three and a half miles east of the northern three miles of the Proposed Action Gen-Tie Route in the Humboldt Range. Low value Sage-grouse habitat encompasses most of the Humboldt Range and comes within a half mile of the proposed gen-tie route at several points (Nevada Department of Wildlife 2011).

Twelve active or occupied golden eagle nests were found within four miles of the proposed gen-tie route during the golden eagle survey. Table 3.9, Golden Eagle Nest Distances to Gen-tie Line Options shows the exact distance from the proposed gen-tie route to each specific nest (Pondera Ecological Consulting 2011).

Table 3.9. Golden Eagle Nest Distances to Gen-Tie Line Options

Golden Eagle Nest Reference Number	Status of Nest[1]	Distance in miles from Proposed Action Gen-Tie	Distance in miles from Alternative 1 Gen-Tie
36	Inactive nest	7.03	7.03
37	Inactive nest	8.23	8.23
38	Inactive nest	8.55	8.55
39	Active nest	8.51	8.51
40	Inactive nest	7.64	7.64
41	Active nest	6.31	6.31

42	Inactive nest	2.57	2.57
43	Active nest	2.48	2.48
44	Active nest	2.51	2.51
45	Active nest	3.40	1.11
46	Inactive nest	3.90	1.48
47	Inactive nest	4.99	1.14
48	Inactive nest	3.67	.71
49	Not mapped		
50	Active nest	12.33	1.73
51	Inactive nest	11.03	1.63
52	Inactive nest	8.44	.62
53	Not mapped		
54	Inactive nest	3.99	7.68
55	Inactive nest	4.06	7.57
56	Inactive nest	1.74	7.45
57	Inactive nest	2.15	7.04
58	Inactive nest	1.52	7.37
59	Occupied nest	3.47	4.50
60	Active nest	3.39	3.93
61	Active nest	2.42	3.53
62	Inactive nest	4.30	2.17
63	Occupied nest	7.64	2.58
64	Not mapped		
65	Active nest	8.32	2.72
66	Active nest	8.40	2.92
67	Active nest	8.03	3.52
68	Not mapped		
69	Not mapped		
1. Source: TGP 2011			

3.18.6. Alternative 1 Gen-Tie Route Project Area

No special status or BLM-sensitive species were observed along the Alternative 1 gen-tie route during the field surveys, though several special status species have the potential to exist (Table 3.8). According to the Nevada Department of Wildlife, there is potential bighorn sheep habitat in the northern five to six miles of Alternative 1.

As shown in Figure 16, Sage-grouse Preliminary General Habitat can be found five miles to the west of the northern six miles of the Alternative 1 Gen-Tie Route in the Humboldt Range. Low value Sage-grouse habitat encompasses most of the Humboldt Range and comes within 1,000 feet of the Alternative 1 Gen-Tie Route near its mid-point.

Thirteen active or occupied golden eagle nests were found within 10 miles of Alternative 1 during the golden eagle survey. Table 3.9, Golden Eagle Nest Distances to Gen-tie Line Options, shows the exact distance from Alternative 1 to each specific nest (Pondera Ecological Consulting 2011).

3.19. Vegetation

3.19.1. Methods

In addition to ground surveys, researchers used existing geographical information systems (GIS) land-cover data from the SWReGAP (US Geological Survey 2004) for preliminary Project habitat mapping. Vegetation types and acreages of each type were calculated for the Project Area and are shown in Figure 17, Vegetation.

3.19.2. Ground Survey

Researchers conducted a habitat assessment of the proposed Geothermal Development Area on June 30 and July 1, 2009. SWReGAP land-cover data were supplemented and updated with field observations (CH2M HILL 2009). Two EMPSi biologists conducted an additional field survey of the gen-tie routes on May 11 and 12, and May 23 through 26, 2011 (EMPSi 2012). The survey corridor for the gen-tie options encompassed a buffer of 100 feet on either side of all three gen-tie options and sub-options. The SWReGAP data were used as a basis for field verification of vegetation communities, and EMPSi recorded information about vegetation types and habitat conditions while walking meandering transects along the gen-tie option routes (EMPSi 2012).

3.19.3. Regional Overview

The Project Area is located within the Great Basin eco-region, which is a cold desert characterized by a series of uplifted mountain ranges and their associated intervening valleys. Elevations range from approximately 3,450 feet to 6,000 feet. The Stillwater National Wildlife Refuge is located approximately 40 miles to the southwest of the Geothermal Development Area.

3.19.3.1. Vegetation Types within the Project Area

Table 3.10, SWReGAP Land-cover Types within the Project Area, presents the SWReGAP land-cover types, land-cover description, and associated acreages within the Geothermal Development Area and within each gen-tie route Project Area.

3.19.3.2. Inter-Mountain Basins Mixed Salt Desert Shrub

The mixed salt desert shrub community occurs on both sides of the Stillwater Range along all three gen-tie routes. It is composed of fairly equal amounts of Bailey's greasewood (*Sarcobatus baileyi*), rabbitbrush (*Chrysothamnus nauseosus* and *C. viscidiflorus*), and budsage (*Artemisia spinescens*). Horsebrush (*Tetradymia spinosa* and *T. glabrata*), Nevada ephedra (*Ephedra nevadensis*), and spiny hopsage (*Grayia spinosa*) were occasionally observed. Some areas mapped as mixed salt desert scrub are dominated by invasive species such as cheatgrass, red brome (*Bromus rubens*), flixweed (*Descurainia sophia*), and clasping pepperweed (*Lepidium perfoliatum*). Other forbs and grasses observed include steppe bluegrass (*Poa secunda*), pincushion (*Chaenactis* sp.), prince's plume (*Stanleya pinnata*), desert dandelion (*Malacothrix* sp.), globemallow (*Sphaeralcea ambigua*), fiddleneck (*Amsinckia tessellata*), redstem filaree (*Erodium cicutarium*), halogeton, and Great Basin wildrye (*Leymus cinereus*) (EMPSi 2012).

3.19.3.3. Inter-Mountain Basin Big Sagebrush Shrubland

Big sagebrush shrubland is found throughout the Project Area. This vegetation community is dominated by big sagebrush (*Artemisia tridentata*), approximately three to four feet tall. In some areas, the forb component is dominated by cheatgrass. Other species observed within this habitat type include shrubs such as Nevada ephedra, snakeweed (*Gutierrezia sarothrae*), budsage, green rabbitbrush (*Ericameria teretifolia*), and shadscale (*Atriplex confertifolia*). Utah juniper (*Juniperus osteosperma*) trees are occasionally interspersed. Forb composition includes heliotrope phacelia (*Phacelia crenulata*), longleaf phlox (*Phlox longifolia*), cushion phlox (*Leptodactylon caespitosum*), paintbrush (*Castilleja angustifolia*), and bur buttercup (*Ceratocephala testiculata*) (EMPSi 2012).

3.19.3.4. Inter-mountain Basins Greasewood Flat

Greasewood flat is found in low-lying sites within the Project Area, intergrading with the mixed salt desert shrub vegetation community. Greasewood flat is dominated by robust, usually three to four feet tall Bailey's greasewood, with a few rabbitbrush, budsage, and shadscale shrubs associated. In certain locations, tamarisk (*Tamarix ramosissima*) exists in this community. The forb and grass component was similar to the mixed salt desert scrub community (EMPSi 2012).

Table 3.10. SWReGAP Land-cover Types within the Project Area

SWReGAP Land-cover Type	Land-cover Description	Approximate Acres		
		Geothermal Development Area	Proposed Action Gen-Tie Route	Alternative 1 Gen-Tie Route
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 by a typically open to moderately dense shrubland composed of one or more saltbush (*Atriplex*) species. Herbaceous layer varies from sparse to moderately dense.	21,060	1,046	918
Inter-Mountain Basins Big Sagebrush Shrubland	Found 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.	3,580	265	2
Inter-Mountain Basins Greasewood Flat	Typically found 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 found as a mosaic of multiple communities, with open to moderately dense shrublands dominated by greasewood (*Sarcobatus* spp.). Often surrounded by mixed salt desert scrub.	260	84	93

Great Basin Pinyon-Juniper Woodland	Found on warm, dry sites on mountain slopes, mesas, plateaus, and ridges of the Great Basin region and eastern foothills of the Sierra Nevada. Vegetation is dominated by a mix of pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*), or pure or nearly pure stands of either species.	2,050	0	0
Invasive Shrubland, Forbland, or Grassland	Areas dominated by introduced shrubs and annual, biennial, and perennial forbs and grasses.	280	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	Found at lower elevations on alluvial fans and flats with moderate to deep soils. Typically dominated by over 25% cover of graminoids with an open shrub layer. The woody layer is often a mixture of shrubs and dwarf-shrubs.	590	13	0
Great Basin Xeric Mixed Sagebrush Shrubland	Found on dry flats and plains, alluvial fans, rolling hills, rocky hillslopes, saddles, and ridges at elevations between 3,300 and 8,500 feet. Soils are typically shallow, rocky, and non-saline. Shrublands are dominated by black sagebrush (*Artemisia nova*) at mid and low elevations and low sagebrush (*A. arbuscula*) at higher elevations. The herbaceous layer is generally sparse.	730	8	0
Inter-Mountain Basins Semi-Desert Grassland	Found on dry plains and mesas between 4,750 and 7,610 feet elevation. Sites are typically xeric and substrates are often well-drained sandy or loamy-textured soils. The dominant perennial bunchgrasses and shrubs are very drought-resistant plants.	20	5	0
Inter-Mountain Basins Playa	Composed of barren and sparsely vegetated playas (generally less than 10% plant cover); salt crusts common, with small saltgrass (*Distichlis s*p.) beds in depressions and sparse shrubs around the margins; intermittently flooded.	0	3	0
Barren Lands	Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulation of earthen material. Generally, vegetation accounts for less than 15% of total cover.	0	1	0
Source: US Geological Survey 2004				

3.19.3.5. Great Basin Pinyon-Juniper Woodland

Pinyon-juniper woodland is found within the Geothermal Development Area in the Stillwater Range from approximately 5,400 feet to 6,000 feet elevation. Soils are generally rocky, and the community is a fairly open woodland. Shrubs are interspersed with the trees, including big sagebrush, rubber rabbitbrush (*Chrysothamnus nauseosus*), and desert snowberry (*Symphoricarpos longiflorus*). Forbs include layia (*Layia glandulosa*), small lupine (*Lupinus pusillus* var. *pusillus*), Lahontan beardtongue (*Penstemon palmeri* var. *macranthus*), cushion buckwheat (*Eriogonum caespitosum*), and Pursh's milkvetch (*Astragalus purshii* var. *lagopinus*) (EMPSi 2012).

3.19.3.6. Invasive Shrubland, Forbland and Grassland

Invasive shrubland, forbland, and grassland are found in small patches within the Project Area. These areas are generally dominated by invasive forbs and grasses, such as cheatgrass, flixweed, clasping pepperweed, and red brome. A few native shrubs exist, such as budsage and shadscale (EMPSi 2012).

3.19.3.7. Inter-Mountain Basins Semi-Desert Sagebrush Shrub Steppe

This vegetation community is found throughout the Project Area, often where the mixed salt desert shrub community intergrades with big sagebrush shrubland. The community is open, with short shrubs such as budsage, shadscale, and rabbitbrush, and forbs and grasses such as Indian ricegrass (*Achnatherum hymenoides*), steppe bluegrass, and cheatgrass (EMPSi 2012).

3.19.3.8. Great Basin Xeric Mixed Sagebrush Shrubland

Mixed sagebrush shrubland is mapped within the Geothermal Development Area and along the Proposed Action Gen-Tie Route. It is composed of shorter sagebrush (two to three feet tall) than the big sagebrush shrubland vegetation community. In this community, sagebrush co-dominates with other shrubs, such as rabbitbrush and budsage. Forbs and grasses observed include cheatgrass, steppe bluegrass, phlox species, and squirreltail (EMPSi 2012).

3.19.3.9. Inter-Mountain Basins Semi-Desert Grassland

A small amount of this habitat type is mapped within the Geothermal Development Area and along the Proposed Action Gen-Tie Route in Packard Flat. This community is actually dominated by invasive forbs and grasses (EMPSi 2012).

3.19.3.10. Inter-Mountain Basins Playa

A small acreage of playa is mapped along the Proposed Action and Alternative 1 Gen-Tie Routes. However, this community was not observed during field surveys. In the locations where playa is mapped, vegetation is actually composed of ruderal mixed salt desert shrub grading into greasewood flat (EMPSi 2012).

3.19.3.11. Barren Lands

A very small acreage of barren land is mapped for the Proposed Action Gen-Tie Route. This occurs where the line ties into the Oreana substation (EMPSi 2012).

3.19.4. Geothermal Development Area

Of all the land-cover types that exist within the Geothermal Development Area, Inter-Mountain Basins Mixed Salt Desert Scrub is the most prevalent, comprising over 73 percent of its total acreage. At approximately 13 percent of total land-cover, the Inter-Mountain Basins Big Sagebrush Shrubland is the second most common land-cover type within the Geothermal Development Area. The other land-cover types found within the Geothermal Development Area include Great Basin Pinyon-Juniper Woodland (7 percent), Great Basin Xeric Mixed

Sagebrush Shrubland (2.5 percent), Inter-Mountain Basins Semi-Desert Shrub Steppe (2 percent), Inter-Mountain Basins Greasewood Flat (1 percent), Invasive Shrubland, Forbland, or Grassland (1 percent) and Inter-Mountain Basins Semi-Desert Grassland (0.1 percent).

3.19.5. Proposed Action Gen-Tie Route Project Area

Of all the land-cover types found along the Proposed Action Gen-Tie Route, Inter-Mountain Basins Mixed Salt Desert Shrub is the most prevalent, composing over 70 percent of the Proposed Action Gen-Tie Route's total land-cover. At approximately 18 percent of total land-cover, the Inter-Mountain Basins Big Sagebrush Shrubland is the second most common land-cover type along the Proposed Action Gen-tie Route. The other land-cover types that are present along the Proposed Action Gen-Tie Route include Inter-Mountain Basins Greasewood Flat (6 percent), Invasive Shrubland, Forbland or Grassland (2 percent), and Inter-Mountain Basins Semi-Desert Shrub Steppe (1 percent). The following land-cover types comprise less than one percent of the Proposed Action Gen-tie Route: Great Basin Xeric Mixed Sagebrush Shrubland, Inter-Mountain Basins Semi-Desert Grassland, Inter-Mountain Basins Playa, and Barren Lands.

3.19.6. Alternative 1 Gen-Tie Route Project Area

Of all the land-cover types that exist along the Alternative 1 Gen-Tie Route, Inter-Mountain Basins Mixed Desert Shrub is the most prevalent, composing 89 percent of the Alternative 1 Gen-Tie Route's total land-cover. At approximately 9 percent of total land-cover, the Inter-Mountain Basins Greasewood is the second most common land-cover type along the Alternative 1 Gen-Tie Route. Invasive Shrubland, Forbland, or Grassland makes up 1.5 percent of the land-cover along the Alternative 1 Gen-Tie Route. The following land-cover types comprise less than one percent of the Alternative 1 Gen-tie Route: Inter-Mountain Basins Big Sagebrush Shrubland, Inter-Mountain Basins Semi-Desert Shrub Steppe, and Inter-Mountain Basins Playa

3.20. Visual Resources

The BLM has initiated the visual resource management process to manage the quality of landscapes on public land and to evaluate the potential impacts on visual resources resulting from development activities. Visual resource management class designations are determined by assessing the scenic value of the landscape, viewer sensitivity to the scenery, and the distance of the viewer to the subject landscape. These management classes identify various permissible levels of landscape alteration, while protecting the overall visual quality of the region. They are divided into four levels (Classes I, II, III, and IV). Class I is the most restrictive and Class IV is the least restrictive in terms of changes that are allowed to the characteristic landscape (BLM 1986).

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

The only sensitive viewing areas or vistas identified within visible range of any of the project components were related to Native American use areas. These sensitive viewing areas are located within the Stillwater Range and along a travel route that the Native Americans use to access the

Stillwater Range through the southern portion of the Project Area. Impacts related to Native American uses have been addressed through consultation with the local Native American tribes and are discussed under the Native American Religious Concerns section of this document.

The Project Area is in a fairly remote part of Nevada, which like much of the state is cherished for its dark skies due to minimal light-producing human activities and developments. The only substantive sources of lighting in the Project Area are mining operations at the south end of the Humboldt Range and the Dixie Valley power plant.

3.21. Water Quality

According to the NDWR, there are approximately 35 active water rights in the vicinity of the Project Area within the Buena Vista Valley, including springs, streams, and underground water rights (NDWR 2012).

The Project Area overlies the following 12-digit code hydrologic units, as defined by the US Geological Survey (National Hydrography Dataset 2011):

- 160401081004 - Limerick Canyon
- 160401081033 - Rochester Canyon
- 160502030502 - Upper Packard Wash
- 160600010405 - Fencemaker Canyon-Frontal Buena Vista Valley
- 160600010406 - New York Canyon-Frontal Buena Vista Valley
- 160600010501 - Hughes Canyon-Frontal Buena Vista Valley
- 160600010502 - Frontal Buena Vista Valley
- 160600010503 - Fisher Canyon-Frontal Buena Vista Valley
- 160600010504 - Indian Creek-Frontal Buena Vista Valley
- 160600010600 - Buena Vista Valley
- 160600010906 - Sou Hot Springs-Spring Creek

The Nevada State Engineer has designated the Buena Vista Valley groundwater basin (no. 129), which indicates that permitted groundwater rights in this area approach or exceed the estimated average annual recharge rate, and the water resources are being depleted or require additional administration (NDWR 2012). The Buena Vista Valley has a perennial yield of 10,000 acre-feet per year (AFY), with about 28,000 AFY of committed groundwater rights (BLM 2010a). With the exception of small amounts of stock water use, most water usage (i.e., irrigation) is located in the northern part of the basin (proposed geothermal Project Area is in south end of basin).

Groundwater in the Buena Vista Valley is found in two general water-bearing zones: shallow non-thermal groundwater in unconsolidated basin-fill deposits; and deeper thermal groundwater in a complex sequence of fractured intrusive and extrusive igneous and volcanic rocks. Groundwater in the shallow system generally flows in unconsolidated deposits to the northwest through the Project Area from recharge areas in the Stillwater Range to the playa of Buena Vista

Valley (BLM 2010a). Deep geothermal groundwater moves horizontally in bedrock, and may also move vertically upward and partially mix with shallow groundwater along fault zones where permeability and pressure allow such movement.

Lumos (2010) completed a water well drill site study for TGP to select target locations for drilling. The well was to provide a source of groundwater at a rate of approximately 20 gallons per minute (gpm) for the New York Canyon exploration drilling program. Several existing wells were identified that are being monitored by NDWR. General lithology encountered in the wells consists of clay, silt, sand, and gravel. The following is a list of five existing wells in the Lease Area reported by Lumos (2010) and/or the NDWR database:

- Buena Vista Well: NDWR log 9360; NDWR #9788; depth = 195 feet; 6-inch diameter casing; perforated interval = 80-190 feet; water level = 89 feet below ground surface; stock water; SWSW¼ Sec. 19, T26N, R36E; owner = Estill.
- Estill Ranch Well: NDWR #79469; depth = 300 feet; 10-inch diameter casing; perforated interval = 210-290 feet; water level = 95 feet below ground surface; SESW¼ Sec. 34, T26N, R36E; owner = Estill.
- Union Geothermal Well: NDWR log 61401: depth = 300 feet; water level = 26 feet below ground surface; NWSW¼ Sec. 22, T26N, R35E; owner = Union Geothermal.
- Phillips Petroleum Well: NDWR log 21949: depth = 1,180 feet; water level = 210 feet below ground surface; NW¼ Sec. 36, T26N, R35E; owner = Phillips Petroleum.
- Oil Car Well; NDWR #51541: stock water use; depth unknown; NWNW¼ Sec. 25, T25N, R34E; owner = Estill.

In November 2010, TGP performed a pumping test of the Estill Ranch Well listed above. The step-test was pumped at rates ranging from 10 to 78 gpm. The initial static water level was 95.3 feet below ground surface at the beginning of the test. At the end of the 7-hour pumping period, the water level was 174.3 feet below ground surface. Recovery was monitored for 1 hour, at which time the water level had risen to 97.1 feet below ground surface.

Depth to groundwater is generally less than 100 feet for the wells that are 300 feet deep or less. The Phillips Petroleum well that is 1,180 feet deep has a reported water level of 210 feet below ground surface.

3.22. Wild Horse Management

The Lease Area is located almost entirely within the 181,883-acre North Stillwater Herd Management Area (HMA), which straddles the Churchill/Pershing County line (BLM 2009). A total of 132,428 acres of the HMA are located in the Winnemucca District Office area, and 49,240 acres are within the Carson City Field Office area. Although the HMA includes ten allotments, only four allotments accommodate horses. Wild horses in this HMA spend the winter and most of the spring months on the west side of the Stillwater range in the vicinity of Logan Spring and Big Ben Canyon. As weather warms, the herd moves up to higher elevations. The appropriate management level for wild horses in the HMA is from 138-205 horses. The gen-tie routes extend out of the North Stillwater HMA into areas not within HMAs.

3.23. Wildlife

3.23.1. Methods

Information regarding wildlife species within the Project Area is based on the results of biological studies conducted in support of the project between 2009 and 2011 (CH2M HILL 2009, EMPSi 2012). Biological resource surveys were conducted for wildlife, and existing information was reviewed, as described in Section 3.19, Vegetation. Notable habitat features, such as rock outcroppings, burrows, and wetland and riparian areas, were recorded, as were incidental wildlife observations and wildlife signs.

3.23.2. Regional Overview

Table 3.11, Typical Wildlife Species Associated with Habitats within the Project Area, presents the habitat types within the Project Area and the typically associated wildlife species within the Great Basin. Species documented during surveys were characteristic of the habitat types found within the Project Area.

Table 3.11. Typical Wildlife Species Associated with Habitats within the Project Area

Habitat Type[1]	**Associated Species**
Salt Desert Scrub and Shrub Steppe	Pronghorn antelope; coyote; pocket mouse; loggerhead shrike; common raven; side-blotched lizard
Sagebrush Shrubland	Sage sparrow; Great Basin fence lizard; western kingbird; Brewer's sparrow
Greasewood Flat	Black-tailed jackrabbit; white-tailed antelope squirrel; black-throated sparrow; horned lark; desert horned lizard
Pinyon-Juniper Woodland	Pinyon jay; juniper titmouse; mule deer; Great Basin rattlesnake; Cassin's finch; chukar
Invasive Shrubland, Forbland, or Grassland	Common raven; red-tailed hawk; burrowing owl; horned lark; pronghorn antelope; collard lizard
Inter-Mountain Basins Playa	Pocket gopher; killdeer; American avocet; black-necked stilt
1. Based on SWReGAP land-cover types	

3.23.3. Game Species

The BLM manages habitat for game species. Within the Project Area, there is potential habitat for the following game species: mule deer (*Odocoileus hemionus*), bighorn sheep (*Ovis canadensis nelsoni*), and pronghorn antelope (*Antilocapra americana*). These species could utilize a number of the habitats within the Project Area, including salt desert scrub, pinyon-juniper woodland, and sagebrush shrubland.

3.23.4. Geothermal Development Area

Wildlife species observed in the New York Canyon Geothermal Development Area were typical of the habitat types described in Section 3.19, Vegetation. Pronghorn antelope was the only game species observed in the Project Area during field surveys.

3.23.5. Proposed Action Gen-Tie Route Project Area

Wildlife species observed along the Proposed Action Gen-Tie Route were typical of the habitat types described in Section 3.19, Vegetation. Pronghorn antelope and mule deer were the only game species observed along the Proposed Action Gen-Tie Route during field surveys.

3.23.6. Alternative 1 Gen-Tie Route Project Area

Wildlife species observed along the Alternative 1 Gen-Tie Route were typical of the habitat types described in Section 3.19, Vegetation. Pronghorn antelope and mule deer were the only game species observed along the Alternative 1 Gen-Tie Route during field surveys.

Figure 10. Wind Rose Data, New York Canyon Project Area

Figure 11. Native American Assessment Area

Figure 12. Water Features

Figure 13. BLM Grazing Allotments

Figure 14. Soil Orders

Figure 15. Farmland Classifications

Figure 16. Preliminary Greater Sage-Grouse Habitat

Figure 17. Vegetation

Chapter 4. Environmental Consequences:

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The following site-specific analysis assesses the direct and indirect impacts of the Proposed Action, Alternative 1, and the No Action alternative.

4.1. Direct and Indirect Impact

4.1.1. Air Quality

4.1.1.1. Applicant Proposed and Environmental Protection Measures

- TGP will surface access roads with aggregate materials, wherever appropriate.
- Speed limits will be posted and enforced to reduce fugitive dust (speed limit of 25 miles per hour, as necessary).
- Dust abatement techniques will be applied to earthmoving, excavating, trenching, and grading activities (such as watering, requiring loader buckets to be emptied slowly, minimizing drop heights, etc.).
- Workers will minimize equipment and vehicle idling times during construction activities.
- Van-pooling of employees between the Lovelock area and the plant site will be encouraged.

4.1.1.2. Proposed Action

Air emissions from the Proposed Action would occur during construction of access roads, gen-tie lines, substation expansion, and the airstrip and hangar; processing and transport of gravel aggregate; well drilling and testing; and construction and operation of the geothermal power plant. Impacts on air quality are discussed below.

The following assumptions were used in this analysis:

- Construction could take 24 months and would disturb approximately 500 acres.
- Dust control measures would have an efficiency of 50 percent.
- There would be 18 worker commute trips per day for 420 days for construction of the gen-tie line, and 120 worker commute trips per day for 520 days for other construction activities.
- Blade, backhoe, scraper, trencher, and dozer equipment are assumed to be each used for 8 hours per day. Use of this equipment would be 90 days for construction of access roads, 40 days for the power plant, 11 days for the airstrip, 90 days for the pipeline, and 160 days for the gen-tie line.
- 50,000 cubic yards (70,875 tons) of gravel would be excavated and transported to the site at an average roundtrip distance of 18 miles.
- Gravel extraction would involve a backhoe and a dozer operating for 8 hours per day each, for 120 days.
- The average commute during construction would be 80 miles roundtrip.

- Calculations shown are based on private vehicle usage and do not take into account emission reductions that would be realized through carpooling.
- 30 new production and injection wells would be drilled and tested with an approximate depth of 10,000 feet.
- Well testing would be conducted for an average of three days (24 hours per day) at each well.
- Initial rates of geothermal fluid flow from each well would be approximately 500 to 1,500 gallons per minute (gpm) on average, with up to 72,000 gallons (approximately 600,000 pounds) per hour.
- Geothermal fluids would have similar chemical makeup as those observed at the nearby Dixie Valley power plant.
- Well drilling and testing emissions would occur over a 24-month period.
- Each well would be drilled for 15 days using a 1,000 HP main deck, 600 HP auxiliary pump, and 150 HP generator.
- Completion and testing of each well would take 30 days using a 600 HP main deck, 225 HP auxiliary pump, and 150 HP power swivel.
- 10 tractor-trailer round trips would occur per well pad to bring drill rig equipment to each well pad.
- During well drilling and testing, there would be 8 commute vehicle round trips per day for 45 days for each of 30 wells with a roundtrip distance of 80 miles. Drilling of multiple wells could happen concurrently and drilling could be spread across a two year timeframe.
- 16 employees would staff the operating power plant. All of these employees would live in Fallon and would commute by aircraft.
- Aircraft emissions during operations assume a single engine piston high performance aircraft (300 HP) with 44 takeoff and landing cycles per week and 22 hours of cruise time per week.

Impact indicators would be:

- Mass of pollutants estimated to be released to atmosphere as determined through screening level analysis.
- Resultant pollutant concentrations based on modeling and compared against National Ambient Air Quality Standards.
- Resultant hydrogen sulfide concentrations compared to the Nevada ambient standard for this pollutant.
- Levels of greenhouse gas emissions.

4.1.1.2.1. Construction

The Proposed Action would have impacts on air quality resulting from construction over a period of 24 months. Site grading and travel on unpaved roadways would generate localized fugitive

dust emissions. Exhaust from gas- and diesel-powered construction equipment, tractor-trailers delivering and moving equipment, and construction personnel vehicles would generate criteria air pollutant and greenhouse gas emissions.

The primary pollutants of concern during construction activities would be PM10 and PM2.5 in the form of fugitive dust. Fugitive dust would be generated from earth-moving activities and vehicle travel on unpaved roads during construction. Fugitive dust emissions would be localized and temporary. The NDEP, Bureau of Air Pollution Control (NDEP-BAPC) requires all projects that would disturb more than five acres to obtain a surface area disturbance permit prior to construction. A dust control plan must be prepared for all projects that require a surface area disturbance permit from NDEP. This dust control plan would include measures to be implemented during construction to reduce fugitive dust emissions. These measures could include applying water to actively disturbed areas or using soil-binding agents, using wind-breaks, limiting vehicle speeds on unpaved surfaces, and gravelling project access roads. Implementation of dust-control measures such as these would minimize air quality impacts related to fugitive dust emissions.

Tail-pipe emissions would result from the use of heavy construction equipment, construction workforce vehicles, and tractor trailers and other heavy-duty vehicles used to access the Project Area.

Construction Emissions are shown in Table 4.1, Screening Level Analysis of Construction Emissions.

Table 4.1. Screening Level Analysis of Construction Emissions (tons)

	VOC	NOx	CO	SO2	PM10	PM2.5	CO2
Fugitive Dust[1]		—	—	—	67.72	6.77	—
Construction Equipment Exhaust[2]	0.29	3.14	1.61	0.07	0.27	0.26	340
Commute Vehicles Emission	16.95	14.26	38.45	0.03	0.67	0.55	2,565
Total Emissions	**17.24**	**17.4**	**40.06**	**0.1**	**68.66**	**7.58**	**2,866**

Notes: Emissions are for two-year construction period.

1. Source: AP-42 Volume I, Section 13.2.3 Heavy Construction Operations for TSP Emission Factor; Section 13.2.4 Aggregate Handling and Storage Piles for conversion from TSP to PM10; and Midwest Research Institute 2006, *Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors* for PM10 to PM2.5 conversion factor.

2. Emission factors based on equipment horsepower rating using EPA NONROADS model.

4.1.1.2.2. Gravel Processing and Transport

The Proposed Action could require a maximum of 50,000 cubic yards of gravel, which would likely be sourced from an existing aggregate pit in the Project Area (see Section 2.2.6, Gravel Needs and Sources). For a period of up to 24 months, gravel excavation, crushing, and screening would generate criteria pollutant emissions from equipment exhaust and localized dust emissions from excavating and processing the gravel. Gravel transport to the construction sites would create criteria pollutant emissions from truck exhaust and localized fugitive dust emissions along

roadways. Table 4.2, Screening Level Analysis of Gravel Processing and Transport Emissions, estimates these emissions.

Table 4.2. Screening Level Analysis of Gravel Processing and Transport Emissions (tons)

	VOC	NO**x**	**CO**	SO**2**	**PM10**	**PM2.5**	CO**2**
Fugitive dust [1]	--	--	--	--	4.46	0.45	--
Construction Equipment Exhaust [2]	0.09	0.90	0.45	0.02	0.08	0.08	102
Dump Truck Emissions [3]	0.02	0.13	0.09	0.00	0.01	0.01	40
Total Emissions	**0.11**	**1.03**	**0.54**	**0.02**	**4.55**	**0.54**	**142**

1. Emissions from transfer, bulk drops, truck unloading, screening, crushing, and storage piles of 50,000 cubic yards (70,875 tons) of gravel (Assuming 1.4175 tons per cubic yard for dry gravel from: http://www.stabiligrid.biz/tools_weights_calculators_convertors.htm). Sources: AP-42 Section 11.9, Supplement A (Feb 1996); Section 13.2.4 Aggregate Handling and Storage Piles for conversion from TSP to PM10; and Midwest Research Institute 2006, *Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors* for PM10 to PM2.5 conversion factor.

2. Emissions for backhoe and dozer operating for 8 hours per day per piece of equipment. Assumes 120 days of use for each piece of equipment. Emission factors based on equipment horsepower rating using EPA NONROADS model.

3. Assumes 2,500 round trips at 18 miles per roundtrip.

As described in Section 2.2.6, fugitive dust at the aggregate pit would be controlled through watering.

4.1.1.2.3. Well Field and Power Plant

The primary sources of emissions during well drilling would be diesel-powered engines on the drill rig, emissions from tractor-trailer deliveries, and other vehicle emissions. These emissions would elevate pollutant concentrations in the vicinity of the Proposed Action for up to two years. Other ancillary equipment such as pumps would also be a temporary source of project emissions.

In addition to diesel equipment and vehicle emissions, well drilling has the potential to release NCGs such as carbon dioxide, hydrogen sulfide, nitrogen, ammonia, methane, hydrogen, and argon. The amount and ratio of gases varies by geothermal resource, with carbon dioxide generally comprising the majority of the NCGs. Hydrogen sulfide is the NCG of greatest concern because, at high concentrations, it can pose a threat to human health. Hydrogen sulfide releases are of greatest concern in the event of a well blowout.

Methane concentrations are estimated to be less than 1 percent of NCGs, based on historical chemistry data. At the project proponent's Dixie Valley geothermal operations, the recycling of the geothermal fluids over time resulted in a falling concentration of NCGs, with hydrogen sulfide dropping to a range of 20 to 45 parts per million within the first 7 years. The current analysis shows the hydrogen sulfide range has dropped from the ranges stated above down to a range of 18 to 32 parts per million (TGP 2012).

Total potential emissions from the proposed well testing of 30 wells would be approximately 0.32 tons hydrogen sulfide per well. These emissions would be short term, lasting until the well is closed or connected to the pipeline.

Air emission sources that exceed five tons per year of criteria air pollutant emissions require an air permit from the NDEP-BAPC. The Proposed Action would require a temporary permit because project-related emissions would be greater than five tons per year. The emissions expected per well during well drilling are shown in Table 4.3, Total Well Drilling Emissions.

Table 4.3. Total Well Drilling Emissions 1 (tons)

	VOC	NOx	CO	SO2	PM10	PM2.5	CO2
Drilling operations[2]	8.79	117.29	31.74	2.62	6.57	6.37	13,598
Truck and commute vehicles[3]	2.09	2.45	5.02	0.01	0.16	0.13	522
Total Well Drilling-Related Emissions	**10.88**	**119.74**	**36.76**	**2.63**	**6.73**	**6.5**	**14,120**

1. 1 Total emissions for 30 new wells. Emissions would occur over 24-month construction period, with multiple wells developed on 15 well pads.
2. 2 Assumes 15 days of drilling (using 1,000 HP main deck, 600 HP auxiliary pump, and 150 HP generator) and 30 days of well completion and testing (using 600 HP main deck, 225 HP auxiliary pump, and 150 HP power swivel).
3. 3 10 tractor-trailer round trips per well pad to bring drill rig equipment to each well pad; 8 rounds trip per day commute vehicles for 45 days for each of 30 wells. More than one well would be drilled at once and emissions could occur over a time period as long as two years. Roundtrip distance is 80 miles.

4.1.1.2.4. Operation

Operational sources of air emissions include combustion equipment, vehicle and aircraft commute traffic, and the geothermal plant operations. Operational emissions, discussed below, have been estimated based on actual emissions at the nearby Dixie Valley geothermal power plant, which is similar in size to the proposed New York Canyon geothermal plant and draws on a similar geothermal resource. The emissions shown in Table 4.4 represent the maximum emissions scenario that would be associated with a flash plant or combined cycle technology. A binary technology plant would not release any such emissions because it is a closed loop system (Table 4.5).

4.1.1.2.4.1. Combustion Equipment

Minor combustion-related emissions would be generated by an emergency diesel fire-pump engine, emergency generators located on production pads, and a black-start diesel generator. Emergency generators would be necessary because the New York Canyon project is in a remote location, and the power plant would not be able to pull power off the transmission line when the plant is not operating.

Specific sizes and models for this equipment are not yet available, but emissions have been estimated based on the air quality permit for the nearby Dixie Valley geothermal plant's emergency

black-start generator, which is permitted to run a maximum of 499 hours per year. These emissions are shown in Table 4.4, Operational Emissions for a Flash or Combined Cycle Plant.

Table 4.4. Operational Emissions for a Flash or Combined Cycle Plant (tons per year)

	VOC	NOx	CO	SO2	PM10	PM2.5	H2S	CO2
Black-start diesel generator 1	0.75	13.66	10.7	1.84	1.135	--	--	--
Geother-mal Plant 2	0	0	0	0	0.087	--	190	31,0003
Aircraft commute trips 4	0.78	1.51	48.1	0	--	--	--	178
Total per year	**1.53**	**15.17**	**58.8**	**1.84**	**1.222**	**--**	**190**	**31,178**

1. Emission levels based on potential to emit permit of the Dixie Valley geothermal plant black-start diesel generator

2. Estimates based on Dixie Valley geothermal plant emissions. H2S emissions would be associated with flash plant technology; binary plant technology does not emit H2S. H2S emissions are initial estimates; these emissions should decrease by half over a 10 year time frame. Neither H2S nor PM10 emissions would occur if a binary technology is selected.

3. Estimate based on emissions at nearby Dixie Valley power plant.

4. Estimates based on *Aircraft Piston Engine Emissions Summary Report*, Federal Office of Civil Aviation, June 2007 (http://www.bazl.admin.ch/fachleute/01169/02432/02433/02588/index.html?lang=en), Table 8, Emissions for landing and takeoff cycle for a single engine piston high performance aircraft (300 HP) and Table 14, Emissions for one-hour cruise for a single engine piston high performance aircraft (300 HP). Emission estimates assume 44 takeoff and landing cycles per week and 22 hours of cruise time per week. VOCs are total hydrocarbons.

Table 4.5. Operational Emissions for a Binary Plant (tons per year)

	VOC	NOx	CO	SO2	PM10	PM2.5	H2S	CO2
Black-start diesel generator 1	0.75	13.66	10.7	1.84	1.135	--	--	--
Geother-mal Plant 2	0	0	0	0	0	--	0	0
Aircraft commute trips 4	0.78	1.51	48.1	0	--	--	--	178

Total per year	1.53	15.17	58.8	1.84	1.222	--	0	178

1. Emission levels based on potential to emit permit of the Dixie Valley geothermal plant black-start diesel generator
2. Binary plants are closed systems and do not release emissions.
3. Estimate based on emissions at nearby Dixie Valley power plant.
4. Estimates based on *Aircraft Piston Engine Emissions Summary Report*, Federal Office of Civil Aviation, June 2007 (http://www.bazl.admin.ch/fachleute/01169/02432/02433/02588/index.html?lang=en), Table 8, Emissions for landing and takeoff cycle for a single engine piston high performance aircraft (300 HP) and Table 14, Emissions for one-hour cruise for a single engine piston high performance aircraft (300 HP). Emission estimates assume 44 takeoff and landing cycles per week and 22 hours of cruise time per week. VOCs are total hydrocarbons.

Other combustion emissions are expected to be minimal because they would be used only during monthly testing and emergency or outage conditions. In addition, the equipment would be subject to federal emission standards outlined in 40 CFR Part 60 Subpart IIII, 40 CFR Part 60 Subpart JJJJ, and 40 CFR Part 63 Subpart ZZZZ.

4.1.1.2.4.2. Geothermal Plant Operation

The proposed geothermal plant would utilize flash, binary, or combined-cycle technology to produce electricity from the geothermal resource. While the geothermal power plant technology has not been selected, the final technology selection would be based on an evaluation of the geothermal resource and construction cost considerations. Greenhouse gases, hydrogen sulfide, and PM10 would be emitted if a flash or combined-cycle technology is selected; however, none of these emissions would occur if a binary system is selected. A qualitative discussion of the anticipated air quality impacts from each technology are described below, while quantitative estimates of emissions based on similar geothermal plant operations in the Project Area are shown in Tables 4.4 and 4.5.

In addition to direct emissions described below, operation of the New York Canyon geothermal facility would have an indirect impact on greenhouse gas emissions if the power produced by the geothermal plant displaced electricity generated by conventional sources of electricity.

4.1.1.2.4.2.1. Flash System

Based on data collected at the nearby Dixie Valley geothermal power plant that has been in operation for over 23 years, TGP anticipates that the geothermal steam to the plant would have approximately 2,500 parts per million by weight of NCGs, of which approximately 98 percent would be carbon dioxide and about 0.5 percent would be hydrogen sulfide. The other gases would consist primarily of nitrogen, ammonia, methane, hydrogen, and argon. Actual levels of NCGs would be determined once well testing has been completed.

Comparing steam chemistry analysis, Dixie Valley would have emitted some 31,000 tons carbon dioxide in the first year of operations (1988), dropping to 22,000 tons by 1991, and down to 16,000 tons by 1994. Within six years the NCG's, including carbon dioxide, had dropped by half. Degassing of the NCG's in the reservoir happened fairly quickly, providing evidence of recycling of the water and demonstrating that it is a renewable resource. A similar schedule of carbon dioxide emissions over time is expected for a New York Canyon power plant.

The BLM used the American Meteorological Society/EPA Regulatory Model (AERMOD) and meteorological data from the National Weather Service station in Winnemucca to model hydrogen sulfide emissions from New York Canyon geothermal operations. The results from the model show the second high maximum 1-hour average concentration to be in the range of 4.59 to 9.33 µg/m3 depending on the year of meteorological data used, which is well below the Nevada H2S ambient standard of 112 µg/m3. The BLM memo in which the model results are discussed, Dispersion Modeling for New York Canyon Geothermal Environmental Assessment, is included in Appendix D (*Appendices are available for download from the project website under "Documents"*). (BLM 2013).

PM10 emissions are anticipated to be less than 0.1 tons per year.

Geothermal steam does not contain sulfur dioxide, carbon monoxide, or nitrogen oxide.

4.1.1.2.4.2.2. Binary Cycle

A binary cycle plant may use wet or dry cooling.

With dry cooling, there are no emissions.

Wet cooling would have emissions of water vapor from the cooling tower and emissions of particulates in the cooling tower drift. These emissions would continue throughout the power plant lifetime. Emissions of water vapor from cooling towers can form a vapor plume during times of high humidity when the water vapor is not readily absorbed into the atmosphere. In the climate of northern Nevada, this usually occurs in the colder months, when the air temperature drops and the air humidity increases. Cooling tower drift is a type of moisture release that results when small quantities of water droplets of 10 microns or greater and dissolved solids become airborne and are carried out with the exhaust air. Cooling tower drift is controlled and minimized through the use of drift eliminators.

4.1.1.2.4.2.3. Combined Cycle

The combined-cycle system integrates both the flash and binary systems. TGP would expect the combined-cycle system to emit a combination of the air emissions described for both flash and binary systems.

4.1.1.2.4.3. Well Field

Small amounts of emissions, similar to those discussed under well development, would be generated during periodic well maintenance.

4.1.1.2.4.4. Commute Traffic

Operation of the power plant would require a permanent workforce of up to 16 professionals in addition to regular maintenance activities supported by outside contractors. Some employees would likely be flown in daily from the nearby city of Fallon, while the others would presumably commute by personal vehicle from Lovelock, a town 30 miles from the Geothermal Development Area. However, this analysis assumes all 16 employees would be flying from Fallon to the Geothermal Development Area to capture the maximum potential commute-related emissions.

The actual number of employees at the plant and, subsequently, the number of hours the plane would be used are dependent upon the geothermal power plant technology selected. For this analysis it is assumed the plane would use 22 incremental flight hours each week, which is the number of flight hours necessary to transport the number of employees needed to operate a flash system plant. Of the three systems, the flash system plant would require the most air-travel time for employees, so if a different system is selected the impact would be less than what is analyzed in this section.

TGP would use a Bonanza A36 to transport employees. This aircraft consumes 17 gallons of fuel an hour, and would result in 374 gallons of fuel consumed per week through the duration of the plant operation.

The burning of aviation fuel produces carbon dioxide, VOCs, water vapor, carbon monoxide, sulfur oxide, and nitrogen oxide. Typically, carbon dioxide comprises 70 percent of aircraft engine emissions; water vapor, slightly less than 30 percent; and VOCs, nitrogen oxide, carbon monoxide, and sulfur oxide less than one percent of emissions (Federal Aviation Association 2005). According to the US Energy Information Administration, aviation gasoline emits 18.33 pounds carbon dioxide per gallon. Nitrous oxide is emitted at 0.11 g/gal fuel; methane is at 7.05 g/gal fuel. Using these numbers to calculate emissions, the Bonanza A36 would emit 178 tons of carbon dioxide a year, 0.002 tons of nitrous oxide a year, and 0.14 tons of methane a year. Emissions resulting from the aircraft commute are identified in Table 4.4, Operational Emissions for a Flash or Combined Cycle Plant.

4.1.1.2.4.5. Gen-Tie Lines

Air emissions from the maintenance of the gen-ties would result from annual line inspections conducted using helicopters, all-terrain vehicles, or line trucks. Line inspections would result in emissions from the burning of fuel and would also contribute to fugitive dust from the use of dirt access roads. Because these inspections would occur no more than once a year, except in the event of an emergency, impacts on air quality resulting from maintenance of these gen-tie lines would be minimal.

4.1.1.2.5. Recommended Mitigation

No mitigation has been recommended.

4.1.1.3. Alternative 1

4.1.1.3.1. Construction

4.1.1.3.1.1. Well Field and Power Plant

Impacts of constructing the well field and power plant would be the same as described under the Proposed Action.

4.1.1.3.1.2. Interconnection Lines and Substation

Impacts from constructing the Alternative 1 Gen-Tie and substation would be similar to those described for the proposed action, as a similar number of acres would be temporarily and permanently disturbed.

4.1.1.3.2. Operation

4.1.1.3.2.1. Well Field and Power Plant

Emissions under Alternative I are expected to be the same as those under the Proposed Action.

4.1.1.3.2.2. Interconnection Lines and Substation

Emissions for the maintenance of a power line would be the same as described under the Proposed Action.

Impacts under Alternative 1 would be the same as described under the Proposed Action.

4.1.1.3.3. Recommended Mitigation

No mitigation has been recommended.

4.1.1.4. No Action Alternative

Under the No Action Alternative, air quality impacts would occur as analyzed in Section 4.1 Air Quality, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.2. Cultural Resources

4.1.2.1. Lease Stipulations

- The Proposed Action will comply with Section 106 of the National Historic Preservation Act.

4.1.2.2. Applicant Proposed Environmental Protection Measures

- TGP will avoid any disturbance within 30 feet of cairns (rock piles) within the Lease Area. TGP would stake-and-flag a 30-foot radius around the cairns and provide avoidance instructions to all on-site personnel and contractors.
- TGP will avoid ground disturbance of all NRHP eligible archaeological sites.

4.1.2.3. Proposed Action

Impact indicators would be:

- Intersect of project components with NRHP eligible sites.

- Introduction of new access routes within close proximity to NRHP eligible sites.
- Introduction of new human traffic within close proximity to NRHP eligible sites.

As noted above, the lease stipulations do not allow any adverse impacts to NRHP eligible sites. The NRHP eligible sites within the Lease Area are CrNV-02-9535, CrNV-02-9577, and CrNV-2-11083. These lease stipulations, in addition to mitigation associated with implementation of the exploration project provide additional protections to the historic road and would still be in effect for this proposed project.

The surveyed gen-tie route passes through the NRHP eligible Rochester Historic Mining District and the eligible site CrNV-02-11724. The route through the Rochester Historic Mining District avoids contributing elements and is not considered to present a visual impact to the setting of the district. The Proposed Action Gen-Tie route passes over NRHP eligible CrNV-02-11724, and the transmission line access road may pass through the site.

BLM has provided the location data of the cairns (man-made rock piles) to TGP. TGP has agreed to stake-and-flag a 30-foot radius around the cairns and provide avoidance instructions to all on-site personnel and contractors. There would be no impacts to the cairns.

4.1.2.3.1. Recommended Mitigation

- TGP shall install fencing at a 30-foot radius around all cairns identified by the BLM. TGP shall coordinate with the BLM range specialist to determine the appropriate type of fencing.
- TGP shall provide training to all onsite employees on the importance of protecting cultural resources and the consequences of any violations. This training shall be presented every two years to continuing employees.
- Signage shall be implemented to indicate that access roads through the plant area and well pads are “no through traffic.”
- The traditional roads identified as CrNV-02-9535 and CrNV-02-9577 shall not be utilized by TGP for drilling, plant construction and/or access to the plant.
- TGP shall provide a 50 meter avoidance buffer on each of the traditional roads identified as CrNV-02-9535 and CrNV-02-9577. All disturbance and development shall be at least 50 meters (164 feet) away from these traditional routes.
- No construction, drilling or geothermal production shall occur within a ¼ mile of a boundary of a known NRHP eligible TCP.
- Since the proponent has agreed to avoid all NRHP eligible archaeological sites, no access roads would be permitted through NRHP eligible archaeological sites. Should access roads have to pass through contributing elements of any NRHP eligible archaeological site, a data recovery/mitigation plan should be developed before construction. This is to insure compliance with Section 106 of the National Historic Preservation Act.

4.1.2.4. Alternative 1

Impacts under Alternative 1 would be the same as described under the Proposed Action.

4.1.2.4.1. Recommended Mitigation

Recommended mitigation under Alternative 1 would be the same as described for the Proposed Action.

4.1.2.5. No Action Alternative

Under the No Action Alternative, cultural resources impacts would occur as analyzed in Section 4.2 Cultural Resources, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.3. Invasive, Non-Native Species

4.1.3.1. Lease Stipulations

- During all phases of development, TGP shall maintain a noxious weed program consisting of monitoring and eradication for species on the Nevada Designated Noxious Weed List (NRS 555.010).

4.1.3.2. Applicant Proposed Environmental Protection Measures

- Prior to construction, TGP will submit to BLM an invasive plant management plan to monitor and control noxious weeds. At a minimum, the plan would incorporate the following measures:
- Existing weed infestations would be treated prior to disturbance. The location of the weeds would be communicated to the Humboldt River Field Office weed coordinator, and treatment methods and herbicides used would be discussed prior to treatment."
- Herbicides would be applied per label instructions.
- BLM or other personnel applying herbicides would use personal protective equipment while spraying or handling herbicides.
- Herbicide application operations would be suspended when wind speed exceeds 6 miles per hour or when precipitation is imminent.
- Some treatment areas could be signed, if needed, indicating the herbicide used and the date of treatment. Areas which that are isolated and/or receive very little use by human beings would not be signed.
- During herbicide treatments, a pre-application sweep of the area would be completed (i.e., looking for nesting birds). Any areas that become infested with weeds during construction would be mapped and treated.

4.1.3.3. Proposed Action

Impacts would be determined based on

- The acreage of disturbance of existing vegetation and the acreage over which incoming vehicles and equipment would travel, potentially bringing in seeds of invasive, non-native species or spreading the seeds of such species already present; and

- The potential for the introduction of new noxious weed infestations that do not currently exist in the Project Area.

All ground-disturbing activities (temporary or permanent) could facilitate the invasion and spread of invasive, non-native species, particularly where soil moisture is increased by applying water for dust suppression. Furthermore, humans and vehicles can inadvertently carry invasive, non-native seeds on their clothing, shoes, tires, and on the undercarriage of vehicles. The potential for the Proposed Action to increase the spread of invasive, non-native and noxious plants species would be minimized by the implementation of the invasive plant management plan and by using BMPs described in Section 4.1.19, Vegetation. Vegetation removal would be restricted to the minimum amount necessary in order to lessen impacts.

Power plant operations would have less likelihood of increasing the spread of invasive, non-native, and noxious species since there would be no ground disturbing activities and vehicles would use the access roads for travel that were already established during the construction phase of the project.

4.1.3.3.1. Recommended Mitigation

- TGP shall revise the Invasive Plant Management Plan in place for the exploration phase to include all portions of the Project Area, including the Geothermal Development Area and the selected gen-tie route, and to address ongoing operations and maintenance activities. This plan would be submitted to the BLM and would need to receive BLM approval prior to issuance of any Notice to Proceed and/or right-of-way grant. The plan should include, at a minimum, a proposed inventory schedule, including season of inventory, reporting schedule, methods of treatment and success criteria. Methods of treatment shall follow standard BLM Standard Operating Procedures and Best Management Practices.

4.1.3.4. Alternative 1

The risk of spreading invasive, non-native and noxious species would be slightly less under Alternative 1 than under the Proposed Action due to the reduced acreage of disturbance.

4.1.3.4.1. Recommended Mitigation

- Recommended mitigation under Alternative 1 would be the same as described for the Proposed Action.

4.1.3.5. No Action Alternative

Under the No Action Alternative, invasive, non-native species impacts would occur as analyzed in Section 4.3 Invasive, Non-native Species, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.4. Migratory Birds

4.1.4.1. Lease Stipulations

- Surface disturbing activities during the migratory bird nesting season (April through July) may be restricted in order to avoid potential violation of the Migratory Bird Act.

4.1.4.2. Applicant Proposed Environmental Protection Measures

- Migratory bird protection measures are listed under Section 2.1.11.6, Raptors, which discusses the Bird and Bat Conservation Strategy/Eagle Conservation Plan.

4.1.4.3. Proposed Action

Impact indicators would be:

- Acres of temporary and permanently lost nesting and foraging habitat.
- Noise levels introduced to the Project Area.
- Project features that could pose a risk of injury, mortality, or increased predation.

A variety of factors can lead to avian mortality at utility sites and two primary causes are electrocution and blunt trauma from collision. As described above, power plants, substations, switching stations, geothermal and injection wells, and pipelines are not anticipated to have substantive avian interactions and are unlikely to pose a threat. In addition, noise caused by construction activities and use of the airstrip may disturb nesting birds as described below.

4.1.4.3.1. Electrocution

Avian electrocutions can occur when an animal completes an electric circuit by simultaneously touching two energized parts or an energized part and a grounded part of the electrical equipment. Improperly constructed power lines, especially distribution lines, are one cause of direct mortality for avian species and can result in electrocution of birds attempting to use these structures for perching and nesting (Harness and Wilson 2001).

4.1.4.3.1.1. Gen-Tie Line

Electrocution of birds is unlikely from newer constructed gen-tie lines that use avian-safe practices regarding conductor separation and grounding procedures according to guidelines published by the Avian Power Line Interaction Committee (Avian Power Line Interaction Committee 2006). Likewise, 230-kV transmission lines do not pose a threat via electrocution due to the distance between the conductor lines and ground lines. These spans are greater than six feet, which is the average wing span of large raptors.

4.1.4.3.1.2. Bird Nesting on Gen-Tie Line Tower

Nests that pose the greatest risk to birds are those that are built in close proximity to energized conductors and hardware. A nest that is not in close proximity to energized parts may not be an

electrocution risk in and of itself, but it could pose a risk to adult birds that may routinely land on other parts of the power pole or surrounding poles where a bird could complete an electric circuit (Avian Power Line Interaction Committee 2006). The design of the proposed towers minimizes the nesting potential because the towers do not provide adequate anchoring points for nest materials. Nesting on the towers is not an anticipated risk to birds.

4.1.4.3.1.3. Substations and Switching Stations

Electrical outages at substations have been caused by direct animal contact (electrocution), nesting, fecal contamination, and bird fecal streams. To prevent these outages, modern substations and switching stations are constructed to reduce the likelihood of birds interacting with components that may result in electrocutions (and power outages). This is done by shielding or enclosing transformers, bus work, circuit breakers, insulators, and switches as well as by design and layout within the stations.

4.1.4.3.2. Collision

The gen-tie line poses a threat to avian species through collision with the line during flight. Vulnerability to collision depends on many factors including bird behavior and maneuverability, topography, weather, and power line design and placement. Bird collision with power lines has been documented for decades, and risk of collision is considered highest in areas where birds congregate, such as power lines that bisect daily flight paths to meadows, wetlands or river valleys. There are no wetlands or riparian areas in the Project Area.

A recent study on how birds see outlined that many types of birds may have significant "blind spots," increasing risk of collision even during daylight. Movements of a bird's head during flight such as scanning below for foraging or roost site can render them blind to objects in the direction of travel. The study examined only a few species but extrapolated visual challenges of other orders of birds based on physiology and other published literature. These "blind spots" are related to how birds forage for food, as well as the position and size of eyes (Martin and Shaw 2010). The implication is that some species of birds (e.g., cranes and storks) are more likely to collide with power lines than others, even during optimal flight conditions.

The gen-tie is the project component within the Project Area that has the greatest risk for avian collision. Cooling towers of power plants are not likely to pose a threat to birds, nor would substations or switching stations.

The mechanisms of avian collision risk outlined above would apply to the proposed and alternative gen-tie lines. The open landscapes closer to where birds might congregate, such as playa habitats, likely have greater risk than areas already containing substantial topographic obstacles around which birds must navigate.

Construction would occur over a 24-month period and would have short-term impacts on air quality, noise, and lighting from site grading and exhaust from gas- and diesel-powered construction equipment, tractor-trailers delivering and moving equipment, and construction personnel vehicles. The construction of the project, including power plants, pipeline, the airfield, access roads, and well pads, would cause a temporary disturbance of 245 acres of migratory bird habitat, and permanent disturbance of 268 acres. Temporary effects from noise, human presence, and heavy equipment present during construction activities could lead to reduced nesting success for individual birds displaced into surrounding areas. Further, those individuals that are not

displaced could be affected by the fragmentation caused by the overall footprint of the project, leading to reduced nesting success.

Construction noise may disturb birds nesting in the vicinity of project features, resulting in nest abandonment. During construction, construction noise would be greatest near construction sites and attenuate outward from there.

Figure 18, Construction Noise from Proposed Action Gen-Tie and Tie Line Options depicts the anticipated noise levels from gen-tie construction. Figure 19, Power Plant Construction and Operation Noise Contours for Golden Eagle Impact Analysis, shows the anticipated noise levels from power plant construction and operation including noise generated from takeoff and landings at the air strip. Birds nesting within these zones could experience noise disturbance depending on their sensitivity and proximity to the project features. Heavy equipment used to prepare access roads and pole locations would generate noise up to 95 A-weighted decibels (dBA) at 50 feet. These noise levels would attenuate down to approximately 83 dBA at a distance of 200 feet. Figures 18 and 19 show the peak noise levels that would be experienced across the project vicinity. Gen-tie structures would be constructed over a period of 13 months, equating to approximately 2 days of work time per structure. Within those two days at any given structure, those sound levels would be experienced for a portion of that time, during the noisiest aspects of site preparation.

The noise modeling shown in Figure 18 used 95 dBA at 50 feet since many of the bat habitat locations are within a few hundred yards of the proposed gen-tie construction noise source and any additional attenuation by vegetation, soils and topography would be negligible within this short distance.

The noise modeling shown in Figure 19 used 90 dBA at 50 feet, which was reduced by 5 dBA from than the maximum expected noise of 95 dBA to account for some noise absorption from vegetation, soils and topography. This lower source noise level was applied to Figure 19 since sensitive bird locations have been recorded at a greater distance from these project features than in the previous figure and natural sound absorption is more pronounced over such distances. The reduction from 95 dBA to 90 dBA in the modeling takes this into consideration for these noise projections out over distance. Figure 19 includes the East power plant location, which is the site closest to identified eagle nests. Figure 19 also includes the maximum sound level that would be experienced across the project vicinity during takeoff and landings at the airstrip.

The Project Area is assumed to have ambient sound levels between 30 and 40 dBA although some areas of the Proposed Action Gen-Tie Route may be higher due to mining activities and associated traffic. Studies of raptor species exposed to aircraft overflight or similar episodic loud noise showed minimal effect on nesting behavior, productivity or reoccupancy (Ellis et al. 1991; Manci et al. 1988). Nesting raptors appeared to quickly habituate to noises, and were observed to react negatively mainly to repeated aircraft flights within 0.5 miles of a nest. Studies of other bird species suggested disturbance thresholds in the range of 60 to 85 dB (NoiseQuest 2013).

Foraging birds are unlikely to be affected by construction and operational noise as they would likely avoid noisy areas and forage elsewhere.

4.1.4.3.3. Indirect Impacts

Avian species, typically raptors, take advantage of transmission lines, distribution poles, trees and other perch sites that provide viewing advantages and increase hunting success. Transmission lines, depending on structure design may also afford suitable nesting substrates for birds. Cross

arms on distribution or lower voltage lines and structures with lattice towers are commonly occupied by corvids and occasionally red-tailed hawks. The proposed design is not commonly used by corvids or hawks for nesting, though nesting could occur. Nesting by raptors or corvids would increase predation in habitat directly surrounding the nest, potentially resulting in a decline in the nesting success of migratory birds that serve as prey.

4.1.4.3.4. Recommended Mitigation

- All preconstruction surveys shall follow standard Winnemucca District protocol. Where a protocol does not exist, proposed survey protocols must be approved by Winnemucca District prior to implementation.

4.1.4.4. Alternative 1

Impacts under Alternative 1 would be as described under the Proposed Action but is expected to result in slightly fewer impacts on migratory birds due to a slightly lower acreage of disturbance and associated habitat removal and the slightly shorter length of the gen-tie line. Construction noise along the Alternative 1 Gen-Tie Route would be generated as shown in Figure 19, Power Plant Construction and Operation Noise Contours for Golden Eagle Impact Analysis and Figure 20, Construction Noise from Alternative 1 Gen-Tie and Tie Line Options.

4.1.4.4.1. Recommended Mitigation

Recommended mitigation under Alternative 1 would be the same as described for the Proposed Action.

4.1.4.5. No Action Alternative

Under the No Action Alternative, migratory bird impacts would occur as analyzed in Section 4.4 Migratory Birds, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.5. Native American Religious Concerns

4.1.5.1. Lease Stipulations

- Lease numbers N-74854, N-76298, N-76299, N-76300, and N-76301 include the following stipulations: “Further development, including exploration, in Potentially Valuable Area (PVA) #12 (New York Canyon and surrounding area), cannot take place unless additional environmental analysis concludes that such development would not have an adverse effect on Traditional Cultural Properties (TCPs)” and “Further development, including exploration, in the New York Canyon Known Geothermal Resource Area and adjacent noncompetitive lease application areas, cannot take place unless additional environmental analysis concludes that such development would not have an adverse effect on Traditional Cultural Properties (TCPs)”.
- Older leases (76298, 76299, 76300, 76301, 86890) stipulate that there must be no surface occupancy within the setting of NRHP eligible TCPs where integrity of the setting is critical to their eligibility.

- Lease numbers N-86893, N-88814 and N-86890 include the following stipulation: "No surface occupancy in or near TCPs or sacred sites".

4.1.5.2. Applicant Proposed Environmental Protection Measures

- To minimize the visibility of project features, the power plant, pipelines, and well heads will be painted a color that blends with the surrounding area, as approved by the BLM.
- To avoid light pollution onto adjacent areas as viewed from a distance, TGP will utilize lighting directed downward on to the site only and away from adjacent areas. TGP will utilize lighting that is hooded and shielded for all lighting associated with the project so as not to allow the bulb to shine up or out with the exception of vehicle headlamps and lighting required by the Federal Aviation Administration.
- To minimize the visibility of pipelines in the southern two thirds of the southern polygon, TGP proposes to paint any pipelines installed in this area in a camouflaging color pattern to reduce any potential visibility from Cornish Canyon. For pipelines aligned perpendicular to Cornish Canyon, only the side of the pipeline facing the TCP would be camouflaged. For other angles, painting would be done so as to camouflage all visible portions of the visible segments. A painting plan would be developed in coordination with BLM. TGP would employ an adaptive management approach to addressing any other visible portions of pipeline across the Project Area that were not anticipated to be visible in the Line of Sight analysis and in the visual simulations. This adaptive management approach would consist of the following steps:

    1. If any BLM-verified complaints regarding the visibility of the pipelines are received from Tribal members, TGP would work with the BLM to identify the visible portions and would paint them in a camouflage color pattern.

    2. For any sections of pipeline that remain visible from the TCPs after camouflaging with paint, TGP would then coordinate with BLM and incorporate vegetative screening along the eastern side of the affected sections. Plants preliminarily identified by the BLM as being suitable for such use include Sage brush, Basin wildrye (*Leymus cinereus*) and Sandberg bluegrass (*Poa secunda*).

4.1.5.3. Proposed Action

Impact indicators would be:

- The degree and duration of visibility of project features and project effects (lighting, steam) from traditional use areas.
- Noise levels introduced to the traditional use areas.
- Changes in access to traditional use areas.

Consultation letters for the Proposed Project were sent out to the Fallon Paiute-Shoshone Tribe, the Lovelock Paiute Tribe, Pyramid Lake Paiute Tribe, and interested tribal members from April 14 to April 25, 2011. Follow-up letters were sent on March 12, 2012. The project was introduced to representatives from the Fallon Paiute-Shoshone Tribe in consultation and informational meetings on June 15th and July 20th 2011. Calls to arrange a consultation meeting were made on July 5, 2012, and messages left with the receptionists at each tribal headquarters.

Consultation meetings were held with the Lovelock Paiute Tribe on September 19th, 2012 and October 10th, 2012. A meeting with users of the TCPs was also held on October 10th, 2012. A joint consultation meeting with representatives from the Fallon Paiute-Shoshone Tribe and the Lovelock Paiute Tribe were held on March 15, 2013.

From previous consultations, it was known that there could be visual impacts from the exploration drilling and well pads (including sumps) on the setting of the TCPs. To assess any potential impacts to the eligible TCPs, a line-of-sight analysis and visual simulations were done from several key observation points (KOPs). The KOPs were determined by the users of the TCPs. A summary of the results of the line-of-sight analysis is provided in Appendix E (*Appendices are available for download from the project website under "Documents"*)..

For the line of sight analysis, geographical information systems (GIS) was used to determine which points on the landscape were visible from each of the 13 KOPs. Within GIS, digital elevation model was used that recreates the three dimensional topography of the landscape. Also taking into consideration the curvature of the earth, the GIS allowed for projecting theoretical lines of site outward in all directions from each KOP, and showing the places within the viewshed that were visible, and those that were not visible due to intervening topography. This approach was helpful in narrowing down which KOPs had the greatest potential for visibility of project features, but it was limited in that the approach did not take into consideration the height of the viewer, the height of the project feature above the land surface, or the effect of intervening vegetation and atmospheric haze.

It was then determined that three dimensional modeling and the production of visual simulations was required to more accurately determine visual impacts to the KOPs. High-resolution panoramic digital photographs were taken from 13 identified KOPs. Portions of the panorama that faced the potentially visible components of the proposed project were selected as the background images for the simulations. Accurately scaled three dimensional models of a power plant and of gen-tie towers were inserted into Google Earth and placed at the proposed locations in the landscape. Turning on the "terrain" feature of Google Earth allowed for a three dimensional rendering of the landscape topography. With all of the three dimensional models of the project components in their correct places, the landscape was then viewed from each of the KOPs using the "Ground Level View" feature of Google Earth. The Ground Level View feature simulated the view of the landscape and any inserted three dimensional models from the perspective of a standing human being. The view in Google Earth was matched to the KOP photographs taken. Using Photoshop, the position and scale of any visible project features were inserted into the KOP photographs and appropriate levels of haze and shading were added to make the simulations more realistic.

The viewshed analysis indicates the power plant, regardless of the site selected from amongst the four identified potential sites, would be visible from two of the thirteen KOPs. These two KOPs are not pine nut collection sites, but rather locations selected along the road that crosses Buena Vista Valley that would be traveled by automobile en route to the Stillwater Range. At the time the visual simulations were prepared, the Proposed Action included a gen-tie line that extended across the Fencemaker Pass into Dixie Valley. This gen-tie came close to several KOPs and was highly visible. Given these results, it was determined that the Proposed Action could result in impacts on the viewshed from some of the TCPs through the introduction of gen-tie towers and lines in otherwise natural landscapes that are largely uninterrupted from other man-made features.

The visual simulations were presented to part of the Lovelock Tribal Council on September 19, 2012. For the gen-tie route that was proposed at the time as part of the project through

Fencemaker Pass, one council member noted it looked "bad" and the traditional users would be unhappy with the transmission line through there. With the meeting of the full council on October 10, 2012, the council members did not express an opinion on any of the transmission lines in terms of "good" or "bad", but did note that they were visible in the simulations. The council did express the following concerns:

1. Would their access to any of the TCPs be limited by the development of the geothermal resource?
2. What will be the lighting of the plant at night? How will it appear from the TCPs?
3. How much new access road will be built for the transmission lines? How will this effect access in and out of the TCPs.
4. How many pinyon trees will be cut to put in the transmission lines?
5. Will a steam cloud be visible from the plant? What time of year will it be visible?
6. What would be the noise generated by construction of the plant, the drilling of the wells, and the operation of the plant? How noisy will the plane flights be? This is a concern since the quiet and serenity of the TCPs are important elements.
7. What would be the visual impact of the well pads, piping and roads going into the plant? One of the reasons they go to the TCPs is for solitude and to escape the modern world around them.

The tribe expressed frustration with the proponent. They claimed that the proponent had promised them that the construction and drilling would occur in phases and they would be notified on how the plant would be developed. As discussed in Section 2.3, Alternative Considered but not Analyzed in Detail, TGP decided to remove the Fencemaker Pass gen-tie line from the Proposed Action, greatly reducing the visual effects of the project on Native American use sites.

The following paragraphs address the three impact questions from above that were put forth by the Lovelock Tribal Council and a user of the TCPs:

1. Access to TCPs would not be limited by implementation of the Proposed Action. The BLM has added mitigation (see below) to ensure this potential impact is avoided.
2. The plant would not be visible from any of the TCPs. There would be no visibility of plant lighting from the TCPs at night. TGP would utilize lighting directed downward on to the site only and away from adjacent areas. TGP would utilize lighting that is hooded and shielded for all lighting associated with the project so as not to allow the bulb to shine up or out with the exception of vehicle headlamps and lighting required by the Federal Aviation Administration.
3. The gen-tie through the Stillwater Range has been removed; there would be no impact on access to TCPs.
4. The gen-tie through the Stillwater Range has been removed; there would be no impact on pinyon trees near the TCPs.
5. A steam plume would be visible if a flash technology or binary with hybrid-cooling technology were selected for the power plant. If one of these technologies were chosen,

steam plumes would be visible when the surrounding air is cold. In such a case, it is estimated that steam plumes would be visible during the daytime from November through March, and during the early morning in April, May, September and October. The visibility of the steam plume would generally be limited to areas where the power plant would be visible. The line-of-sight and viewshed analysis indicates that the power plant would not be visible from the KOPs inside the TCPs; therefore, it is anticipated that only the tops of the steam cloud would be visible to users inside the TCPs.. During pine nut collection season of September and October, such steam plumes are likely only to be visible over ridgelines during the early morning before air temperatures have warmed up. In years where the pine nut collection season extends into November, the chance of steam plume visibility over ridgelines would be greater. Steam plume visibility would be more noticeable on clear days when the white plume would contrast with the blue sky, and less visible on overcast days when the skies are cloudy. If steam generating technologies were selected by TGP, steam plumes would also be visible at a distance of five or more miles from the road used to cross Buena Vista Valley on the way to the Stillwater Range.

6. Operation of the power plant is anticipated to result in noise levels at the TCPs in the range of 20 dBA to 27 dBA. The resultant noise level at any TCP would vary based on the power plant site selected and the TCP of interest. These estimates are based on noise modeling that has been conducted as described in Section 4.1.13, Noise. Typical noise estimates assume line-of-sight visibility between the noise source and the receptor site. Since none of the TCPs are within line-of-sight of the power plant, and since there are several layers of intervening topography between the candidate power plant sites and some of the TCPs, noise reduction would be greater than the simple calculation based on distance. An additional 10 dBA of noise reduction was incorporated into modeling to account for intervening topography and for absorption of sound by ground and vegetation. For reference, and as stated in Section 3.13 Noise, typical quiet rural daytime noise levels outdoors is 45 dBA. The addition of a secondary noise source that is more than 10 dBA lower than the baseline noise source does not make the ambient noise level perceptibly louder to the human ear (Canadian Centre for Occupational Health and Safety 2013). Thus, the addition of a baseline noise of 20 to 27 dBA in the area of the TCPs would not result in a perceptible noise difference. The Proposed Action would not result in a noise impact on the TCPs. Airplane takeoff and landing noise would be imperceptible from any of the TCPs. The primary flight path of the airplane would approach and depart the airstrip from the west, would not cross over the Stillwater Range, and would not result in audible noise at any of the TCPs. The secondary flight path, which will need to be used on occasion when the Navy is restricting airspace, would involve crossing over the Stillwater Range and would generate noise levels over some TCPs for a few minutes a few times per day.

7. The plant would not be visible from any of the KOPs inside the TCPs. The plant would be visible only from points along the roads in the open space of Buena Vista Valley during an approach to the TCPs in the Stillwater Range. The nearest distance between a power plant and the main approach route would be 4.2 miles. This visibility has been shown in visual simulations presented to the Tribal Council.

Any pipelines, access roads and well pads placed in the main (northern) polygon of the Project Area would have a clear line-of-sight with KOPs from distances of several miles and would not be visible to the naked eye. Drill rigs, well pads (including sumps), pipelines and portions of access roads in the southern polygon of the Project Area could be within line-of-sight from the

Dave Canyon car camp and from areas in the vicinity of the Dave Canyon TCP at a distance of 1.0 to 1.5 miles.

Drill rigs would be visible from the Dave Canyon TCPs for up to two pine nut collection seasons. Well pads (including sumps) would also be visible for up to two pine nut collection seasons during drilling and testing operations, but over the longer term would be reduced in their size, revegetated, and be much less visible.

The 36-inch pipeline, painted in camouflaged color patterns to blend in with the environment, viewed from a mile away at an 8 percent angle is unlikely to be visible to the naked eye from the nearest KOP. Any verified complaints from tribal members to the BLM would trigger the adaptive management approach discussed above that could result in additional vegetative screening being established, which would eliminate any remaining pipeline visibility from the TCPs.

Access roads running along pipelines would be graveled and are not expected to be visible due to: (1) Their elevation being at-or-below grade, depending on if scraping is used to level the surface at any particular location; (2) Natural visual screening from the native vegetation on the east side of the roads when viewed from a low angle of 8 percent from the nearest KOP; (3) Coloration of the roads in earthen tones and gravel tones, which are consistent with the landscape. Portions of the road could be somewhat visible due to limited vegetation, but it is expected that due to the low angle and the colors of gravel and earth that any such segments would be few and far between, and would be barely perceptible to the naked eye. It is not expected that access roads would result in long stretches of linear elements in the viewshed.

In accordance with 36 CFR 800.5(a) “In consultation with the SHPO/Tribal Historic Preservation Officer (THPO) and any Indian tribe or Native Hawaiian organization that attaches religious and cultural significance to identified historic properties, the agency official shall apply the criteria of adverse effect to historic properties within the area of potential effects.” According to 36 CFR 800.5(a)(1) “An adverse effect is found when an undertaking may alter directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property’s location, design, setting, material, workmanship, feeling, or association.” According to “Guidelines for Evaluation and Documenting Traditional Properties” adverse effects include “introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting”. For the purposes of this EA, an adverse effect constitutes an adverse impact.

The landscape of the six NRHP eligible TCPs and the Buena Vista Valley is currently relatively unaltered by modern developments. There is an abandoned mining prospect near the Dave Canyon TCP, and the area is also part of a grazing allotment. The leases surrounding the Dave Canyon TCP are not part of a landscape that receives much traffic or other human activity on a daily basis.

The Proposed Action would introduce visual (drill rigs, drill pads, wells, roads, vehicle traffic, and other disturbances), audible (equipment and vehicle noise) and atmospheric (dust associated with vehicle traffic and operations) intrusions that are out of character with the TCP and would adversely affect the integrity of setting and feeling of the Dave Canyon TCP for up to two seasons of use. These intrusions would primarily be temporary (the visibility of drill rigs day and night, drilling noise, equipment noise, dust associated with frequent traffic). Once construction is complete, it is expected that with the mitigation in place, well pads (including sumps), roads and pipelines would be largely invisible to the naked eye, but occasional vehicle traffic and associated dust plumes would be present over the long term.

Since integrity setting and feeling are part of the qualities that make this TCP eligible for listing on the NRHP, these intrusions constitute an adverse effect and an adverse impact both over the short-term (two years) and over the long-term. Tribal members visit this TCP not only to harvest pine nuts, but for "spiritual uplift and renewal" and "maintaining the continuing cultural identity of the community." The Dave Canyon TCP is also a considered a sacred site. Tribal members collect medicines and perform sacred rituals there. It further needs to be stressed, since drilling activities would most likely be going on in the fall when the pine harvest is ongoing, impacts to the integrity of setting and feeling of the TCP would occur during the one or two years of drilling in this portion of the Project Area. Visual simulations prepared for the Exploration EA (BLM 2010) of the drill pads in the southern portion of the Project Area also indicate that there will be visual impacts. The presence of the drill rigs and crews could deter tribal members from even going up to the TCPs to gather pine nuts and participate in the associated activities for the one to two years of active drilling in that portion of the Project Area.

There could also be indirect adverse effects to the Dave Canyon and other TCPs due to increased and improved access. The TCPs are currently protected by its remoteness and relatively poor access. According to the National Register Nomination for Dave Canyon, "Due to the absence of roads leading into Dave Canyon, the area has maintained its qualities of integrity…[of] location, setting, materials, workmanship, feeling and association. Each of these contributes in a positive manner to the overall significance of the property" (Sec. 8, Page 14). The nomination further states, "The canyon and cultural resources associated with pinyon nut harvesting camps shows little disturbance since the prehistoric and historic use of Dave Canyon" (Sec. 8, Page 1).

Proposed new and improved roads in the southern polygon of the Project Area could make the TCPs more accessible and exploration activities could draw more attention to the area, leading to potential impacts to the TCP from dispersed recreation. Potential impacts include damage to and/or destruction of traditional camps, archeological sites and sacred sites. 36 CFR 800.5(2)(i) cites "Physical destruction of or damage to all or part of the property" as an adverse effect. Other potential impacts include additional impacts to the integrity of setting and feeling of the TCP from dispersed recreation.

If TGP were to site well pads in the northeastern portion of the Lease Area, some of these pads could be within line-of-sight of KOP "Logan Spring 4," located along Kitten Springs Road. Any development in this area would be in the flatter portions of the Lease Area that occur between 3 miles and 4.3 miles from that KOP. Given the likely distance of more than three miles to any well pad, access road or pipeline, the gentle slope of the land of approximately 10 percent, the intervening and varied topography, and the dominant presence of the modern Kitten Springs Road in that viewshed, any wellfield development in this portion of the Lease Area would likely not be discernible from the background landscape and would not have an adverse effect on the natural and traditional quality of the landscape from this point along the travel route.

TGP has been working with the Lovelock and Fallon Paiute Tribes through both the exploration and development EA processes. It was acknowledged that TGP's exploration and development plans would result in some level of impact to the natural and traditional quality of the setting for at least one of the TCPs.

4.1.5.3.1. Recommended Mitigation

- TGP would not block access for the Native Americans to CrNV-02-9535 and CrNV-02-9577, nor put any impediments along these two routes which would prohibit travel along these

routes by the Native Americans. Allow Native Americans access to TCPs and sacred sites. TGP would not block access to the road running along the ridge of the Stillwater Range.

- TGP would not conduct any off-road or cross-country travel. All vehicular travel must be on roads built and maintained by TGP.
- Well pads including sump perimeters in the southern leases (N-86890, N-76300, and N-76299) would be successfully re-vegetated within six months after drilling and flow testing. Re-seeding would be done using weed free and BLM approved seed mixtures. If used for production, the remaining unvegetated area must be less than 15 feet x 15 feet.
- All non-emergency construction, drilling and maintenance would be prohibited in the southern leases (N-86890, N-76300, and N-76299) during September and October. If the pine-nut season extends into November, the above-listed activities would be prohibited during that month. Each year, through consultation with the tribes and TCP users, the BLM would determine if the pine nut season extends into November.
- All exploratory drilling would be done within 3 years.
- To reduce visual impacts to the settings of the TCPs, unless used for production, all well pads outside of the leases mentioned in #3 will be reclaimed and revegetated within 6 months of exploratory/production drilling. For the wells used in production, the remaining unvegetated area must be less than 15 feet x 15 feet. All other areas of the production well pad must be re-vegetated within 6 months of construction.
- No pinyon trees marked as “Seed Trees” will be cut down for any of the construction.

The proponent and BLM recommended mitigations (listed above) are sufficient to mitigate the adverse effects to the NRHP eligible TCPs in the vicinity of the Project Area.

A consultation meeting was held with the Fallon Paiute-Shoshone Tribe to discuss the tribe's issue with the preliminary EA on May 17th, 2013. The tribal representatives felt that if the mitigation measures proposed by TGP and the BLM were adopted, they had no objections to the project.

4.1.5.4. Alternative 1

Impacts under Alternative 1 would be as described under the Proposed Action.

4.1.5.4.1. Recommended Mitigation

Recommended mitigation under Alternative 1 would be the same as described under the Proposed Action.

4.1.5.5. No Action Alternative

Under the No Action Alternative, impacts related to Native American religious concerns would occur as analyzed in Section 4.5 Native American Religious Concerns, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.6. Prime or Unique Farmlands

Prime or unique farmlands are addressed under Section 4.1.17, Soils.

4.1.7. Wastes, Hazardous or Solid

4.1.7.1. Lease Stipulations

- Prior to exploration and development, an emergency response plan will be developed that includes contingencies for hazardous materials spills and disposal.

4.1.7.2. Applicant Proposed Environmental Protection Measures

- Small quantities of solid wastes (paper, plastic, and other garbage) generated by the Proposed Action will be transported offsite to an appropriate landfill facility.
- Portable chemical toilet wastes will be removed by a local contractor.
- Sewage generated at the power plant will be treated in an on-site, state-permitted septic system.
- The Spill Prevention, Control, and Countermeasure plan will be submitted to and approved by the BLM and made readily available on site before operations begin.
- Secondary containment structures will be provided for all chemical and petroleum/oil storage areas during drilling operations. Additionally, absorbent pads or sheets will be placed under likely spill sources, and spill kits will be maintained on site during construction and drilling activities to provide prompt response to accidental leaks or spills of chemicals and petroleum products.
- Handling, storage, and disposal of hazardous materials, hazardous wastes, and solid wastes will be conducted in conformance with federal and state regulations to prevent soil, groundwater, or surface water contamination and associated adverse effects on the environment or worker health and safety.

4.1.7.3. Proposed Action

Impact indicators would be:

- The nature and volume of hazardous materials brought into the Project Area as part of the Proposed Action;
- How those materials will be used, stored and transported.
- The deposition of a hazardous materials layer at the bottom of reserve pits through the evaporation of geothermal fluids.
- The flow of acidified geothermal fluids back to the surface after well stimulation activities.

As shown in Table 2.5, Materials and Chemicals Commonly Used During Well Drilling, diesel fuel, lubricants, hydraulic fluids, and drilling chemicals (e.g., drilling mud, caustic soda, barite, and scale inhibitors) would be transported to, stored on, and used at the power plant construction

site. If a binary or combined-cycle unit is selected for power generation, a secondary organic working fluid, such as pentane, isopentane, butane, isobutane, or a refrigerant such as R134A, would be used in a closed system.

The Proposed Action would conform to federal and state requirements for handling these hazardous materials. The storage and use of these materials could result in minor, incidental spills of diesel fuel or oil to the ground during fueling of equipment, filling of fuel storage tanks, and handling lubricants. Other incidental spills could be associated with equipment failures such as ruptured hoses.

Wastes (solid and liquid) would be transported offsite for appropriate disposal consistent with state and federal regulatory requirements. The Proposed Action would generate minimal levels of hazardous waste and would be classified as a Conditionally Exempt Small Quantity Generator under federal regulations. Implementation of these procedures would prevent or minimize potential environmental impacts from project-related hazardous or non-hazardous wastes.

The proposed power plant, substation expansion, pipelines, wells, transmission lines, and access roads would be primarily on undeveloped land where no hazardous materials occur, so the project would not expose workers to any preexisting hazardous materials and wastes during construction, operation, and maintenance.

Project construction and operation phases would involve hazardous material use. These materials would include, but would not be limited to, drilling additives and mud, diesel fuel, lubricants, solvents, oil, equipment/vehicle emissions, geothermal water, laboratory materials, and pentane, isopentane, butane, isobutane, or a refrigerant such as R134A (working fluid). The primary types of exposure to these substances are from inhalation, skin contact, and eye contact. The transport, use, or disposal of such hazardous materials could affect workers, the public, and the environment through accidental spills or emissions. The presence of flammable fuels, working fluids and gases (the flammable fuels in their heated, gaseous state) would expose workers to the risk of fires and explosions.

General geothermal lease stipulations for geothermal developers and site workers would be adhered to in order to address the potential impacts involving hazardous materials.

The geothermal power plant would comply with all local, state, and federal regulations regarding the use, transport, storage, and disposal of hazardous materials and wastes. A detailed reclamation plan would be developed in consultation with the BLM and other stakeholders before the power plant is built and operated.

Some quantities of hazardous and flammable materials would be contained in the systems and stored on site at the power plant site, behind locked gates. The working fluid would be stored in quantities that require review under the Nevada Chemical Accident Prevention Program and the federal Risk Management Prevention program. These programs, typically completed after the final design of the project is complete and prior to the delivery of chemicals, require detailed analyses of the hazards and risks associated with the systems that contain the flammable substances and consideration of the off-site consequences of a worst-case and a reasonably foreseeable accidental release. TGP would maintain its own fire protection system at the site and would prepare an Emergency Response Plan that would address procedures and notification requirements for releases of hazardous substances.

Indirect impacts involving hazardous materials would entail transport and disposal of such materials to off-site locations, which could expose people and lands outside of the Project Area to hazardous materials, potentially resulting in injury to humans through chemical exposure, explosions, or fire. All storage and transportation would be in compliance with state and federal regulations and all workers would comply with Occupational Safety and Health Administration standards, including appropriate use of Personal Protective Equipment.

The Proposed Action would result in the introduction of pentachlorophenol into the environment and would potentially expose workers. Transmission poles would be pre-treated with pentachlorophenol prior to their transportation to the Project Area and workers would comply with Occupational Safety and Health Administration standards, including appropriate use of Personal Protective Equipment, which would reduce the likelihood this potential impact. The effects of this chemical on local water is discussed further under Section 4.1.8, Water Quality.

The Proposed Action would result in evaporation of geothermal fluids within reserve pits, which would concentrate any dissolved or suspended chemicals into the remaining sludge. Contaminant concentrations could reach toxic levels depending on the chemical composition of the fluids and on the volumes evaporated. Such toxic sludge could pose a future health and safety risk to humans, flora and fauna.

Well stimulation activities could result in acidified geothermal fluids being returned and flowed to the surface, which could pose a health and safety risk to humans, flora and fauna.

4.1.7.3.1. Recommended Mitigation

- Reserve pit waste shall be sampled for hazardous contaminants. Typical tests may include the Toxicity Characteristic Leaching Procedure (TCLP) (EPA Method 1311), tested for heavy metals; pH (EPA Method 9045D); Total Petroleum Hydrocarbons/Diesel (EPA Method 8015B); and Oil and Grease (EPA Method 413.1). Contaminated materials, if any, shall be disposed of at an approved facility.

4.1.7.4. Alternative 1

Impacts under Alternative 1 would be as described for the Proposed Action.

4.1.7.4.1. Recommended Mitigation

No mitigation recommended.

4.1.7.5. No Action Alternative

Under the No Action Alternative, impacts related to solid and hazardous wastes and would occur as analyzed in Section 4.7 Wastes, Hazardous or Solid, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.8. Water Quality (Surface/Ground)

4.1.8.1. Lease Stipulations

- Lease stipulations for all leased areas included in the Proposed Action prohibit surface occupancy, including well pad disturbance or construction, within 650 feet (horizontal measurement) of any surface water bodies, riparian areas, wetlands, playas, or 100-year floodplains unless specifically approved by the BLM.

- Lease stipulations for all leased areas included in the Proposed Action require development of a hydrologic monitoring program. This program would include documentation of subsurface information including the number of aquifers encountered, their properties, their quality, and their saturated thickness, for submittal to the BLM. (Note to reader: This lease stipulation has been satisfied with the Water Resources Monitoring Plan described above in Section 4.1.8.1 under the subsection Water Resources Monitoring).

4.1.8.2. Applicant Proposed Environmental Protection Measures

- Development of a construction Stormwater Pollution Prevention Plan and Spill Prevention, Control, and Countermeasures plan.

- Erosion-control measures would be implemented.

- When permanent new access roads must cross ephemeral washes, rolling dips would be installed. The rolling dips would be designed to accommodate flows from at least a 25-year storm event. Culverts may be used wherever rolling dips are not feasible.

- Settled bentonite clay from drilling mud would accumulate on the bottom of the drill pad reserve pits and central sump to act as an unconsolidated clay liner, reducing the potential for drilling fluid to percolate to groundwater.

- A BLM-approved grouting and casing program for construction of observation wells would be implemented to prevent water quality effects on groundwater during or after well installation.

- Borehole geophysics analyses (cement bond logs) would be conducted to document that well casing grouting activities provide an effective seal isolating the geothermal aquifer from shallow alluvial aquifers, therefore minimizing potential impacts on surface springs or streams.

- The project would use BMPs to ensure that any geothermal fluid encountered during the drilling does not flow uncontrolled to the surface. These include the use of “blow-out” prevention equipment during drilling and the installation of well casing cemented into the ground.

- TGP would obtain necessary permits from NDEP for working in ephemeral streambeds and for groundwater discharge and provide a Notice of Intent to NDEP prior to well pad construction.

- TGP would submit a Geothermal Drilling Permit application, including detailed drilling and casing procedures, to BLM for approval prior to initiating geothermal drilling.

- In order to prevent a release of geothermal fluids to surface water features, drilling muds and geothermal fluids would be contained in the well pad reserve pit; or piped or trucked to the large central sump when quantities dictate.
- To avoid communication between the geothermal aquifer and the shallow groundwater aquifer, BMPs for well installation and testing would be implemented.
- A monitoring plan would be put in place to assess whether impacts on quality, quantity, or temperature of surface water occurred as a result of observation well installation and testing.

4.1.8.3. Proposed Action

The following subsections describe environmental impacts on water quality that could result from the Proposed Action. Impact indicators would be:

- Acres of moderately and highly erodible (by wind and water) soils that would be disturbed and the resultant mass of soils transported by erosion into ephemeral washes.
- Number of geothermal wells drilled.
- Concentration of pentachlorophenol, drilling additives, and other substances inadvertently released in the Project Area and that ends up in ground and surface water.
- Number of stream channels disturbed.
- Temperature changes of non-geothermal aquifers.

4.1.8.3.1. Geothermal Wells

A total of 15 exploration wells and well pads were analyzed in and approved based on the Exploration EA for the New York Canyon Project. All 15 wells (if constructed) would be converted to production, injection, or monitor wells via sundry notice to BLM. Up to an additional 30 new production, injection, and monitoring wells would also be constructed on the 15 well pads previously based on the Exploration EA.

The existing exploration wells would be converted to production or injection wells by using the existing well, or by re-drilling the well to provide for a larger-diameter production well. Re-drilling the well would involve pulling the existing steel casing from the hole, increasing the diameter of the hole, and installing larger diameter steel casing.

Each new production and injection well would be drilled and completed to an approximate depth of 10,000 feet over a period of about eight weeks per well. Steel casing, cemented to surface, would then be installed in the drill hole, with progressively smaller diameters as the hole becomes deeper. A non-toxic bentonite clay-water or polymer-water “mud” mixture would be used during the drilling process for the first 3,000 feet of drilling depth. Additional non-hazardous and non-toxic additives would be used with the drilling mud as needed to improve the drilling process. Below a depth of approximately 3,000 feet, the drilling mud may be changed to a soap/foam additive and compressed air. The drilling mud/fluids that come to the surface during drilling procedures are discharged to a reserve pit located on the drill pad. The bermed reserve pit, which would have a capacity of up to 1 million gallons, would be lined with bentonite clay settling on the

bottom to prevent seepage of drill fluids to the subsurface. Ultimately, any fluids that collect in the reserve pit are allowed to evaporate, or are pumped and transported to a permitted disposal facility.

After completion of drilling and casing operations, clean-out and flow tests would be performed on the new or re-drilled wells. The fluids would be routed to the reserve pits. Flow rates to the reserve pits from the tests would typically be in the range of 500 to 1,500 gpm over an average period of three days. Additionally, well stimulation operations, commonly consisting of injecting a dilute mixture of 35 percent solution of hydrochloric acid down the well, may be performed in production and injection wells. After well stimulation, the well may be back-flowed and the pH adjusted back to neutral, if necessary, and discharged to the reserve pit.

Individual production well flow rates during operations are expected to be approximately 2,000 gpm, with total project flows of about 12,000 gpm (19,400 AFY). After power plant processing, injection wells would inject the geothermal fluid produced from the production wells back into the geothermal reservoir. Depending on the type of power plant, injection rates would range from 85 to 100 percent of the geothermal fluid production rates (16,500 to 19,400 AFY). Individual injection wells are expected to receive from 200 to 5,200 gpm (325 to 8,300 AFY) of 225 degrees Fahrenheit (°F) geothermal fluid. Quality of the produced and injected water would be a neutral alkaline-chloride type, with highest concentrations of sodium, potassium, and chloride; and low concentrations of calcium, magnesium, and bicarbonate. The total dissolved solids concentration would be about 2,000 mg/L.

As a result of the reinjection rates of 85 to 100 percent, groundwater drawdown impacts that could translate to shallower depths are not expected to occur due to production well withdrawals. The considerable depth of groundwater production and injection (10,000 feet) allows for adequate separation to prevent potential impacts that could occur on shallow springs and domestic/stock wells. As stated in the EA for the New York Canyon Geothermal Exploration Project (BLM 2010), the deep geothermal aquifer and shallow aquifer are not believed to be hydrologically connected, except in localized areas where preferential pathways may have formed in bedrock. There is no evidence, however, that such movement of geothermal groundwater from deep reservoirs to shallow near-surface groundwater occurs in the Project Area.

Several springs are located up-gradient of the Project Area, near the base of the Stillwater Mountain Range. None of these springs have been identified as having an elevated temperature and, therefore, are likely not connected to deep thermal groundwater (BLM 2010a).

Well completion methods are designed to prevent any drilling fluids or added chemicals from leaving the inner well casing and mixing with aquifers above the geothermal reservoir. Solid steel casing is used for the wells, along with a cement grout in the annulus outside of the casing.

To prevent leaks and spills, secondary containment structures would be provided for all chemical and petroleum/oil storage areas during drilling operations. Spill kits with absorbent pads would be maintained onsite during construction and drilling activities to provide prompt response to accidental leaks and spills. Ground disturbing drill pad activities would also incorporate best management practices (BMPs; e.g. silt fences, hay bales, sediment ditches and traps) in accordance with a Construction Storm Water Pollution Prevention Plan (SWPPP) approved for the Project.

Tracer dyes are used to provide information on well and resource connectivity. Non-hazardous fluorescent chemicals, such as fluorescein, would be used. Radioactive tracer chemicals provide information on well bore status and are often used as part of a well Mechanical Integrity Test.

Radioactive tracers dyes used in well stimulation treatments would have very short half-lives, would break down quickly and would have only short-term impacts on the quality of the water immediately at the wellbore. There would be no long-term water quality effects from either tracer dyes or radioactive tracers. Acid used in well treatments would be neutralized out by scale in the well casing or minerals in the host formation and would have no impact on groundwater acidity. There would be no impact of acid use on surface waters.

There would be no comingling of groundwater aquifers during well drilling, stimulation or treatments. Heavy drilling muds would seal off the formations during drilling. The ground water zones above 2,000 feet depth would typically have two or more sets of casing, cemented to surface and sealing off any potential aquifers.

The cool temperature springs up-gradient from the project could not be affected by well stimulation activities. As mentioned earlier, these springs are hydrologically upstream of the project and are therefore not affected by water quality in the Project Area. Additionally, the multiple casing strings cemented to the surface also protect groundwater aquifers.

The project would be constructed to meet or exceed seismicity standards for the area. The plant would be shut down and wells shut in during an extreme emergency, so no impact on water quality and no surface discharge would occur in the event of a large earthquake.

A major seismic event has the potential to affect aquifers. The impact on shallow alluvial aquifers, where groundwater is more likely to occur would be minimized by the loose nature of the unconsolidated sediments. A geothermal resource in deep bedrock could be affected by a seismic event due to changes in hydraulic connectivity between water sources and heat sources as well as connectivity between geothermal waters and current preferential flow paths (i.e. faults and fractures). Use of the geothermal resource would not cause seismic activity.

Well pads would be previously established as part of the exploration phase of the project and would be sited to avoid ephemeral washes.

4.1.8.3.2. Power Plant

The proposed power plant would be constructed on an approximately 60-acre site in one of four locations (Figure 6, Candidate Plant Locations and Access Roads). A binary technology power plant could require as little as 10 acres, whereas a flash power plant or combined cycle plant could require as much as 60 acres. The 60-acre estimation has been used for analysis. Each of these potential sites would have similar potential impacts on water resources. During ground-disturbing construction, workers would implement BMPs to reduce erosion and sedimentation in accordance with a project-approved Construction SWPPP. Other than the geothermal fluid, no water-type discharges would occur from the power plant.

The four potential power plant locations were selected to avoid ephemeral channels and washes displayed on US Geological Survey topographic maps and visible on aerial photography.

To prevent leaks and spills, secondary containment structures would be provided for all chemical and petroleum/oil storage areas at the plant site. Spill kits with absorbent pads would be maintained onsite during construction and operations to provide prompt response to accidental leaks and spills. An approved Spill Prevention, Control, and Countermeasures (SPCC) Plan would be prepared for the Project.

4.1.8.3.3. Gen-Ties

Ground disturbing activities would occur for construction of the 26-mile long Proposed Action Gen-Tie. As detailed in Table 2.1, a total of 196 support structures would be installed with a maximum of 102 acres of short-term disturbance (short-term disturbance areas would be revegetated per the BLM guidelines). Some erosion may occur at disturbed areas during substantial rain events, especially where original topography is steeper with a soil cover. This could result in distribution of sediment downgradient of the disturbed areas. Workers would implement BMPs to control erosion and sedimentation in accordance with a Construction SWPPP approved for the Project.

After construction is completed, all disturbed areas would be recontoured, decompacted, and seeded with the BLM-approved seed mix shown in Table 2.11, Proposed Seed Mix. Cleared vegetation would be shredded and distributed over disturbed areas as mulch. All man-made construction debris would be removed and disposed of at permitted landfills.

The transmission line poles are treated at the below-ground sections with the biocide pentachlorophenol. The Material Safety Data Sheet for pentachlorophenol indicates that it is very slightly soluble in cold water. Pentachlorophenol is recognized as being highly toxic to all life, and while it is slow to biodegrade, its biodegradation products are known to be more toxic than the chemical itself. The US Department of Transportation classifies pentachlorophenol as a Class 6.1 Poisonous material and the Occupational Health and Safety Administration identifies it as Hazardous (ScienceLab.com 2013). The US Centers for Disease Control acknowledge that while most uses of pentachlorophenol have been banned, it is still approved for use as a treatment for utility poles, railroad ties and wharf pilings. In the case of utility poles, the transport of pentachlorophenol into the environment occurs through evaporation from wood surfaces. Pentachlorophenol is broken down by sunlight, other chemicals, and microorganisms to other chemicals within a couple of days to months (Centers for Disease Control 2001). While the application of pentachlorophenol is intended only for the portion of the poles below the ground surface, a buffer zone of treated wood is generally left above the ground surface. Since pentachlorophenol is only slightly soluble in cold water, it is likely that rainfall will transport small amounts of the chemical onto the surrounding soils during rain events. Subsurface portions of the pole could release pentachlorophenol into moist soils during and after rain and snowmelt events, allowing the chemical to travel down into deeper aquifers. Given the low level of solubility, the pentachlorophenol is not expected to travel far from the pole locations either vertically or laterally. Additionally, none of the waters along the gen-tie route is identified as being part of an aquifer used for drinking water. While minor and localized impacts to groundwater quality could occur, the impact would not affect any identified uses of those waters and the impact would be consistent with utility pole installation across the country, often in much more sensitive areas.

TGP would avoid ephemeral channels and washes when selecting locations for gen-tie structures. This is not only desirable from an environmental perspective, but also for engineering considerations. Ephemeral channels and washes represent low points in the topography. Gen-tie towers would be sited on the highest topography available to maximize the clearance that the gen-tie line would have from the ground. Also, soils within ephemeral channels and washes are less stable due to higher erosion and higher water saturation. TGP would seek to avoid these unstable conditions and would target higher areas on the topography for the gen-tie structures.

4.1.8.3.4. Access Roads and Airstrip

Existing and approved access roads would be sufficient for well drilling and testing activities. BLM Humboldt River Field Office issued ROW Grant N-88195 to TGP on December 1, 2010 for "access roads and a pipeline, 47,308.8 feet long and 25 feet wide containing 27.15 acres on public lands at T25N R36E sec 1, N2, sec. 2, NE, et. al. in Pershing County."

For power plant construction and operation, additional access roads would need to be authorized and constructed to the selected plant location (approximately 2.5 miles of new road). While existing access roads could be used in some areas, for purposes of this analysis, it is assumed that new access roads would be required for nearly the entire length of the gen-tie routes. The Proposed Action would require up to 24 miles of access road, resulting in a long-term disturbance of 21 acres, and an additional temporary disturbance of 25 acres. The proposed airstrip would disturb 15 acres, including parking and access.

The layout of well pads, pipelines, and access roads would occur after completion of the NEPA process, however, it is estimated that 20 to 30 crossings of channels or washes would be required across the Geothermal Development Area. Crossings of washes and channels generally cause erosion and have the potential to change the way water flows through these features. Fast-moving waters from desert flash storms coming down from the mountains through the Geothermal Development Area and into the valley floor are the norm for these washes and channels. Modifications to the shapes of the streambeds and banks can redirect flows and cause additional erosion down into the playa. Such changes to erosion and surface water flows would not change the local groundwater quality or quantity, and no surface waters are present to be affected aside from the ephemeral flows themselves, which are already typically high in dissolved solids.

Erosion would be minimal within the Project Area due to the rolling dips that would be installed at crossings of washes or channels, which would protect soils and the existing topography and streamflow dynamics.

Roads would be designed to minimize impacts on channels and washes by avoiding them, if possible, and implementing BMPs in accordance with an approved Construction Stormwater Pollution Prevention Plan. The goal is to allow any flows to continue in drainages and not be disrupted. Roadside ditches and sediment traps would be used where necessary to control runoff and sedimentation from roadways. Effects on streambeds would be minimized through the mitigation described below and included in Section 2.1.11, Environmental Protection Measures. TGP would submit Application for Temporary Working in Waterways Permit to the Nevada Department of Environmental Protection, as required.

The airstrip would not affect any ephemeral channels or washes.

4.1.8.3.5. Geothermal Fluid Pipelines

Production and injection pipelines would generally follow the shortest routes from each well pad to the next well pad or the power plant to minimize the amount of pipeline and associated ground disturbance. Total long-term surface disturbance for the above-ground pipelines would be as many as 152 acres. All pipeline construction activities would incorporate BMPs to reduce erosion and sedimentation in accordance with a Construction Storm Water Permit approved for the Project. Impacts on pipeline crosses of ephemeral washes are discussed above under "Access Roads and Airstrip."

4.1.8.3.6. Water Resources Monitoring

A Water Resources Monitoring Plan has been developed by TGP and the BLM to monitor the potential impacts from exploration activities on groundwater and surface water in the Project Area. This monitoring plan was accepted by BLM as a condition of approval for the 2010 New York Canyon Exploration Finding of No Significant Impact and decision document (BLM 2010). As drilling and development continue, data would be collected to establish hydrologic baseline conditions and to refine the monitoring program over time. In addition, operational monitoring of geothermal fluid flow, temperature, and pressure would occur continuously. Well integrity would be tested every five years.

A spring inventory would also be conducted for Logan Spring and Taylor Spring following a protocol established by BLM in January 2012 and agreed upon by TGP. This spring inventory would be conducted prior to any exploration activities and would provide baseline conditions at each of the two springs for use in analyzing the results of future monitoring at those springs as part of the Water Resources Monitoring Plan. The inventory would include detailed site descriptions and sketches, a biotic inventory, a description of the geomorphology, flow rate measurements, water temperature, and analysis of selected water quality parameters.

4.1.8.3.7. Recommended Mitigation

- Water would be monitored per a BLM-approved water monitoring plan developed for the development and utilization phase of the project. The plan would be adapted from the water monitoring plan developed for exploration and may include various springs, surface water sources and groundwater sources. Production and utilization activities would not begin until the BLM has approved the adapted (for production and utilization) monitoring plan. To provide an understanding of baseline conditions, at least four quarters of monitoring as directed by the exploration phase monitoring plan must have been completed and implementation of the adapted (for production and utilization) plan must be initiated prior to any production or utilization drilling.

- TGP would not utilize any water from the stock pond, nor the seasonal creeks in any of their operations. TGP would avoid doing any modifications to the stock pond that would destroy its integrity.

- Reserve pit waste shall be sampled for hazardous contaminants. Typical tests may include the Toxicity Characteristic Leaching Procedure (TCLP) (EPA Method 1311), tested for heavy metals; pH (EPA Method 9045D); Total Petroleum Hydrocarbons/Diesel (EPA Method 8015B); and Oil and Grease (EPA Method 413.1). Contaminated materials, if any, shall be disposed of at an approved facility.

4.1.8.4. Alternative 1

For Alternative 1, the Alternative 1 Gen-Tie Route, which would replace the Proposed Action Gen-Tie Route, is a shorter route that would result in less ground disturbance and less potential for erosion and sedimentation for the Project. Alternative 1 would result in less access road construction (long-term disturbance of 12 acres, and an additional temporary disturbance of 94 acres) than the Proposed Action (long-term disturbance of 13 acres and an additional 102 acres

of temporary disturbance). Alternative 1 would add the need for construction of an electrical substation, resulting in an additional disturbance area of five acres.

With respect to potential impacts on water resources, implementation of Alternative 1 would be similar to the Proposed Action.

4.1.8.4.1. Recommended Mitigation

Recommended mitigation under Alternative 1 would be the same as described for the Proposed Action.

4.1.8.5. No Action Alternative

Under the No Action Alternative, water quality impacts would occur as analyzed in Section 4.8 Water Quality (Surface and Ground) and Water Quantity, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.9. Wetlands/Riparian Zones

4.1.9.1. Proposed Action

Impact indicators would be:

- Changes to water quality or flow rate that supports the wetlands or riparian habitat.
- Removal of vegetation, disturbance of soil, or changes in access to wetlands and riparian habitat.

As written in Sections 3.9 Wetlands/Riparian Zones, 3.8 Water Quality, and 3.19 Vegetation, there are no wetlands or riparian zones within the Project Area. No direct impacts would occur under either the Proposed Action or Alternative 1. Indirect impacts could potentially occur as a result of any changes to the upland springs to the east of the Project Area. As discussed in Section 4.1.8, the springs are cold-water springs and occur upland from the project area and are not expected to have any connectivity to the geothermal resources in the Project Area. The Applicant-proposed water monitoring plan would monitor any impacts to these springs during the exploration phase as well as during the well testing phase. Impacts on ephemeral channels and washes within the Project Area are discussed in Section 4.1.8, Water Quality.

4.1.9.1.1. Recommended Mitigation

No mitigation recommended.

4.1.9.2. Alternative 1

Impacts under Alternative 1 would be as described under the Proposed Action

4.1.9.2.1. Recommended Mitigation

No mitigation recommended.

4.1.9.3. No Action Alternative

Under the No Action Alternative, there would be impacts on wetlands and riparian zones.

4.1.10. Access and Transportation

4.1.10.1. Proposed Action

Impact indicators would be:

- Vehicle traffic numbers generated.
- Traffic speeds on existing roads.
- Public's ability to access through the Project Area.

As part of the decision based on the Exploration EA, the Applicant can and may sign-post project access roads as "No Through Access." This would apply to one existing 2–track road that will be built up by the Applicant in addition to any new roads the Applicant constructs to access the well pads. The ability for the public to travel on Dago Pass Road, Kitten Springs Road, and Fencemaker Pass Road would not be affected except for possible slowdowns by construction equipment and related vehicles traveling to and from the Project Area and gravel delivery trucks traveling between the gravel extraction sites and the Project Area.

Traffic would increase along Coal Canyon-Stillwater Road and Dago Pass Road for the duration of the construction and operational phases of the project.

Temporary access restrictions from large, slow moving vehicles may occur during construction, but, overall, access would be maintained for other uses of the area including dispersed recreation and Native American traditional uses. The Proposed Action would include construction of access roads for the power plant and for gen-tie lines. Roads constructed for the power plant and well-field that are not needed after the construction phase would be reclaimed. Roads along the gen-tie route would be reduced to a 2-track road for the operational phase of the project. These remaining roads in the Geothermal Development Area and along the gen-tie route would increase access to previously inaccessible portions of the Project Area.

The project would generate approximately 2,500 round trips between the gravel source location and the Project Area (a negligible number of trips would deliver gravel to selected locations along the gen-tie line). These trips would occur at a rate of approximately 14 per day for a period of 6 months. The average length of these trips from the Fencemaker Pit would be 9 miles. Only local roads in the vicinity of the Lease Area would be affected.

4.1.10.1.1. Recommended Mitigation

No mitigation recommended.

4.1.10.2. Alternative 1

Impacts under Alternative 1 would be the same as under the Proposed Action.

4.1.10.2.1. Recommended Mitigation

No mitigation recommended.

4.1.10.3. No Action Alternative

Under the No Action Alternative, impacts related to access and transportation would not occur as analyzed in the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.11. Fire Management

4.1.11.1. Applicant Proposed Environmental Protection Measures

- All construction and operating equipment will be equipped with applicable exhaust spark arresters.
- Personnel will be trained in fire prevention and initial response, and fire extinguishers will be available at each drill site.
- Water that is used for construction and operations will be available for plant fire suppression.
- Personnel will be allowed to smoke only in designated areas and will be required to follow applicable BLM regulations regarding smoking.

4.1.11.2. Proposed Action

Impact indicators would be:

- New sources of spark or flammable fuel introduced to the Project Area
- Availability of fire-fighting public services.

Implementation of the Proposed Action would increase the potential for human caused fires during construction and drilling activities. Accidental discharge during transportation and storage of flammable materials or chemicals, such as fuel, could accelerate the ignition of fires in the Project Area. Impacts from these fires would vary based on fire size. Development of a hazardous material handling, storage and transportation plan would reduce the potential for fires (see Section 4.1.7, Wastes, Hazardous or Solid). TGP has proposed environmental protection measures to further reduce the potential for human caused fires. The BLM would be informed as soon as possible of all fires that occur within the Lease Area during construction, drilling, and testing. Use of fire control mitigation measures would result in minimal impact on fire management.

During operations, the availability of the plant operating water supply may provide a local source of water to aid with wildfire suppression activities which result from lightning or non-power plant related human actions. The availability of said local water supply should reduce the acres burned from wildfires which may occur in the Project Area.

Churchill and Pershing County Fire Departments have the responsibility to respond to any structure fires or accidents within or along the Project Area, while BLM responds to wildfires on

BLM managed public land. Injured TGP staff or subcontractors would be transported for medical attention by local fire departments, Careflight, or the Fallon Naval Air Station Search and Rescue.

4.1.11.2.1. Recommended Mitigation

No mitigation recommended.

4.1.11.3. Alternative 1

Impacts under Alternative 1 would be as described under the Proposed Action.

4.1.11.3.1. Recommended Mitigation

No mitigation recommended.

4.1.11.4. No Action Alternative

Under the No Action Alternative, impacts related to fire management would occur as analyzed in Section 4.10 Fire Resources, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.12. Lands and Realty

4.1.12.1. Lease Stipulation

- No drilling would be conducted within linear ROWs.

4.1.12.2. Applicant Proposed Environmental Protection Measures

- Applicant shall contact ROW holder for location on underground utilities.
- TGP would coordinate with the owner of any fences intersected by project components and would arrange for the temporary removal of sections of fences for construction access, and for the reinstallation of fences and gates, as needed, to provide access for maintenance activities. Any modifications to existing fences would be done only with prior agreement from the affected fence owner and would be paid for by TGP.

4.1.12.3. Proposed Action

Impact indicators would be:

- Number of existing right-of-ways intersected
- Whether any existing land uses within the Project Area are incompatible with the Proposed Action.

The Proposed Action would not include drilling in existing ROWs, however, construction of access roads, pipelines and gen-ties involve intersecting other linear ROWs. TGP would design all project features in a way that would not conflict with existing approved uses. TGP would coordinate with other ROW holders and with BLM, as necessary, to negotiate any potential effects

on other uses or features. The use of the lands for geothermal development would not preempt the other current uses of the land identified in Section 3.12, Lands and Realty.

4.1.12.3.1. Recommended Mitigation

No mitigation recommended.

4.1.12.4. Alternative 1

Impacts from Alternative 1 would be the same as described for the Proposed Action.

4.1.12.4.1. Recommended Mitigation

No mitigation recommended.

4.1.12.5. No Action Alternative

Under the No Action Alternative, impacts related to lands and realty would occur as analyzed in Section 4.12 Lands and Realty, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.13. Noise

4.1.13.1. Proposed Action

Impact indicators would be:

- The number and proximity of typical sensitive receptors such as residences, schools, hospitals and libraries.

Although no such typical sensitive noise receptors have been identified, there is the potential for noise to impact wildlife and Native American traditional use areas. Impacts expected from gen-tie construction are addressed under Section 4.1.23 Wildlife, and in Section 4.1.5 Native American Religious Concerns.

Noise would be generated over the two-year drilling and construction phase of the project as well as over the long-term from the operation of the power plant and from aircraft takeoff and landings.

The peak construction period for the gen-tie line is expected to last about 13 months. Because of the linear nature of the transmission line portion of the project, workers, noise-making activities, and equipment are not expected to be in one place for a long period of time.

Expected sources of noise associated with the geothermal development portion of the Proposed Action include construction activities (earth-moving equipment for road, pipeline and power plant foundation construction), drilling operations, well testing, power plant operation, and aircraft takeoffs and landings.

Noise modeling was conducted based on existing noise data from geothermal operations at other locations. Table 4.6, Noise Generation Levels by Project Component, shows the various noise sources from the geothermal development and operation phase of the project at a distance of 50 feet. These noise levels can be extrapolated out to any distance to determine the perceptible noise

at any given location by lowering the noise level by 6 dBA for every doubling of distance. The vegetated landscape would also result in “soft ground attenuation.” Soft ground attenuation is when sound passes close to absorbing ground cover such as grassland, fields etc., and this "soft ground" absorbs extra sound as it passes. Noise levels would be substantially reduced even further at sites that do not have line-of-sight visibility of the noise source due to land formations.

Table 4.6. Noise Generation Levels by Project Component

Project Component	Estimated Noise (dBA)
Construction (well pad, power plant, gen-tie)	70 – 95 at 50 feet
Drilling	75 – 85 at 50 feet
Well testing	90 at 50 feet
Power Plant Operation	75 – 85 at 50 feet
Aircraft takeoff and landing	60 at 800 feet
Source: Leitner undated; Rhode Island Airport Corporation 2009.	

Noise would be generated during all phases of project activity as detailed below.

4.1.13.1.1. Impacts from Road, Well Pad and Power Plant Construction

Heavy earth-moving equipment is used to prepare roads, the air strip, the hangar and associated parking, and the power plant site. Sound pressure levels for these activities have been measured in the range of 70 to 95 dBA at a distance of 50 feet (Leitner undated). Construction of the power plant would take approximately 15 months.

4.1.13.1.2. Impacts from Gen-Tie Construction

Heavy equipment used to prepare access roads and pole locations would generate noise up to 95 dBA at 50 feet. Figure 18 shows the peak noise levels that would be experienced across the project vicinity. The 196 support structures would be constructed over a period of 13 months, equating to approximately 2 days of work time per structure. It can be assumed that Figure 18 shows the maximum sound levels that would be experienced at any particular location for a time period of approximately 2 days. Within those two days at any given structure, those sound levels would only be experienced for a portion of that time during the noisiest aspects of site preparation.

4.1.13.1.3. Impacts from Drilling Activities

The dominant noise sources associated with exploratory drilling are the large diesel engines that power the rotary rig and mud pumps and the large diesel-driven air compressors. These noise sources are consistent throughout drilling. Additional intermittent noise sources result from the hoisting of drill pipe or casing and the auto-driller. Hoisting during drilling is usually masked (sound-wise) by the air compressors, but the auto drillers are not. The auto-driller generates a loud squeal one, two, or more times throughout each well hole drilling. Drilling occurs 24 hours per day and is planned to continue for 45 to 60 days per well. Typical sound levels during drilling when mud is used as the circulating medium range from 75 to 85 dBA at 50 feet (Leitner undated).

4.1.13.1.4. Impacts from Well Testing

The process of flowing geothermal wells to test production capability also generates noise. Noise is made primarily by the diesel generator that powers the down-hole electric pump, with lesser

noise emitted from the fluids flowing through the well head and pipeline to the reinjection well. Additional noise may be realized from any additional diesel generator that is required to power a second pump at the injection well. Flow testing occurs 24 hours per day and would be conducted for 30 to 90 days per well.

Data from geothermal exploration in Imperial Valley, California, suggest that sound pressure levels during flow testing can be as high as 90 dBA at 50 feet (Leitner undated).

4.1.13.1.5. Impacts from Power Plant Operation and Aircraft

Noise from power plant operation was calculated using existing noise data for other geothermal power plants. Cooling towers, which are the main noise source in binary power plants, have been recorded as generating noise in the range of 75 to 85 dBA at a distance of 50 feet. Noise would also be generated during the operational phase from the takeoffs and landings of the TGP aircraft. The Bonanza A36 has been recorded as generating noise at 60 dBA at a distance of 800 feet (Rhode Island Airport Corporation 2009). As described in Chapter 2, six flights would occur each day during Monday to Thursday and two flights would occur each day Friday through Sunday. The maximum noise levels that would be experienced across the Project Area as a result of takeoff and landings are shown in Figure 19.

During all phases of the project, noise could be audible by people visiting the Project Area for recreation or other purposes. For example, an individual hiking 0.35 mile from either a well pad under construction or the power plant under construction may experience noise at levels up to 62.5 dBA. Lower noise levels would be experienced at that same distance during well drilling and well testing. Even lower noise levels would be experienced at 0.35 mile from the power plant once construction is complete and the plant is operational.

To assess impacts on Native American uses within the Stillwater Range, the low end of the sound ranges provided in Table 4.6 was used to account for soft ground attenuation that would occur over the large distances (1.5 miles to 7 miles) between the power plant and the Native American sensitive receptors and to account for the additional attenuation that would come from none of the power plant locations nor the airfield being within line of sight of any of the Native American sensitive receptors. Figure 21, Power Plant Construction and Operation Noise Contours for Native American Impact Analysis serves as the basis for impact analysis on Native American traditional use sites. Figure 21 shows anticipated noise contours that would be generated from power plant construction and operation as well as from airplane takeoffs and landings. The noise modeling shown in this figure used 75 dBA at 50 feet, which is at or near the low end of the range of sounds for both construction and operations of the power plant. The low end of the range was used to account for the fact that none of the identified Native American sensitive receptors would have direct line of sight with any of other power plant locations and the distances involved would result in substantial noise absorption by vegetation, soils, and intervening topography. Figure 21 includes both the East and South power plant locations since these are the two sites closest to identified Native American sensitive receptors.

To assess impacts on eagle nests that are within closer proximity, higher elevation, and line-of-sight from proposed project components, less soft ground attenuation is expected and the higher ends of the noise ranges were utilized. Figure 19 shows anticipated noise contours that would be generated from power plant construction and operation as well as from airplane takeoffs and landings. The noise modeling shown in this figure used 90 dBA at 50 feet, which is at or near the high end of the range of sounds for construction and operations of the power plant. Figure

19 shows noise contours that would be generated from the East power plant location since this is the site closest to identified eagle nests. Noise levels would be lower from any of the other candidate power plant locations.

4.1.13.1.6. Recommended Mitigation

No mitigation recommended.

4.1.13.2. Alternative 1

Impacts from Alternative 1 would be the same as described for the Proposed Action except that noise associated with gen-tie construction would be in the locations and at the intensities shown in Figure 20.

4.1.13.2.1. Recommended Mitigation

No mitigation recommended.

4.1.13.3. No Action Alternative

Under the No Action Alternative, noise impacts would occur as analyzed in the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.14. Paleontological Resources

4.1.14.1. Lease Stipulations

- Lease numbers N-86890 and N-86893 have stipulations classifying the Lease Area as possessing a PFYC of 3, and identifying the potential requirement for inventory and/or on-site monitoring during disturbance. Based on additional review, BLM concurs with the conclusion reached in (Spaulding 2009) that the Lease Area possesses a PFYC of 2 and no field inventory or on-site monitoring will be required.
- Lease stipulations require that, in the event that previously undiscovered paleontological resources are discovered in the performance of any surface disturbing activities, the item(s) or condition(s) would be left intact and immediately brought to the attention of the authorized officer of the BLM.

4.1.14.2. Applicant Proposed Environmental Protection Measures

- Subsurface disturbance would not occur in stock pile areas or as a result of overland travel routes.
- TGP will follow the Paleontological Monitoring Plan that has been prepared for this project, including arranging for, in coordination with the BLM, an intensive survey of all areas underlain by geologic units determined by the BLM to have a PFYC Class 4 or higher and coordination regarding any necessary re-routes.

4.1.14.3. Proposed Action

The impact indicator would be:

- The number of acres and miles of Potential Fossil Yield Classification 4 or higher that project components overlie.

Under the Proposed Action, potential impacts on paleontological resources could occur during construction. Subsurface disturbance would occur during gravel excavation, construction of the power plant, gen-tie lines, and installation of wells. Subsurface disturbance would not occur in stock pile areas or as a result of overland travel routes. The area affected by the bulk of the Geothermal Development Area is underlain by coarse Quaternary alluvium that has been designated as possessing a Potential Fossil Yield Classification (PFYC) of 2, or low paleontological sensitivity. PFYC 2 sediments are unlikely to contain vertebrate or scientifically significant invertebrate fossils. While fossils may be present in sediments designated PFYC 2, the chance of encountering them is very low to nonexistent. Other portions of the Project Area, such as in the northern portion of the Lease Area and some portions of the gen-tie routes, may have higher potential to yield fossils. Therefore, the Proposed Action may have adverse effects on paleontological resources.

To address concerns about PFYC 4 along the Proposed Action gen-tie route, a Paleontological Monitoring Plan was prepared (see Appendix C; *Appendices are available for download from the project website under "Documents"*).The plan requires that a pre-construction field survey be conducted of the portions of the Proposed Action traversing BLM-administered lands, with areas of PFYC 4 or higher receiving a higher intensity of surveying. Any fossil occurrences would be documented and recorded at the time of discovery in accordance with BLM policy. Fossils would be collected where feasible at the time of the survey. If the fossil discovery is too large to collect during the survey (e.g., a whale skeleton or bone bed) and requires a large-scale salvage effort, then it would be documented and a mitigation strategy would be devised in consultation with TGP and the BLM. An alternative mitigation such as avoidance and re-routing of the Project alignment in the vicinity of the discovery is also an option. The protections provided under this plan would reduce any impacts on paleontological resources.

4.1.14.3.1. Recommended Mitigation

No mitigation recommended.

4.1.14.4. Alternative 1

Impacts under Alternative 1 would be less than those of the Proposed Action. The alternative gen-tie route would not pass over any areas of PFYC Class 4 or 5..

4.1.14.4.1. Recommended Mitigation

No mitigation recommended.

4.1.14.5. No Action Alternative

Under the No Action Alternative, impacts on paleontological resources would occur as analyzed in Section 4.13 Paleontological Resources, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.15. Range Resources

4.1.15.1. Proposed Action

The impact indicator would be:

- The number of acres of productive grazing lands disturbed and taken out of production over the short-term and long-term.

The Proposed Action would cause temporary disturbance of up to 245 acres, which would be reclaimed, and an additional long-term disturbance of up to 268 acres. Portions of the Proposed Action Gen-Tie Route occur in steep terrain areas and in playas where productive grazing does not occur. Assuming that 80 percent of the disturbance would occur on productive grazing lands, the Proposed Action would result in a temporary disturbance of 196 acres and long-term disturbance of 214 acres of productive grazing lands within grazing allotments.

Temporary and long-term disturbance would destroy vegetation and remove grazing opportunities for the animals being managed within the affected allotments. Additionally, the network of pipelines and the 60-acre fenced-off power plant site would restrict animal movements across the Geothermal Development Area. However, all of the undisturbed lands within the network of pipelines would be accessible for grazing. No lands would be completely closed off by uncrossable pipelines.

Well drilling, construction of access roads, pipelines, the power plant and the airfield would occur solely within the Rochester Allotment. The Proposed Action Gen-Tie would be constructed within the Rochester and Coal Canyon-Poker allotments.

Estimated acres of disturbance were distributed proportionally across allotments based on the acres of each allotment occurring within the Project Area. Table 4.7, Estimated Impacts on Affected Grazing Allotments from the Proposed Action, details the estimated temporary and long-term acres of productive rangelands that would be affected by the proposed action. The table also provides a percentage of the each allotment affected.

Approximately 0.04 percent of productive grazing lands within the Rochester Allotment would be temporary removed from productivity by the Proposed Action and 0.05 percent would be permanently removed. The temporarily disturbed areas would be recontoured and revegetated after construction operations are complete. No reduction in authorized grazing use would be required.

The Coal Canyon-Poker allotments would be affected at a level of less than 0.01 percent temporarily and at a level of 0.01 percent over the long-term. No reduction in authorized grazing use would be required. Aside from these two allotments, no others would be affected.

Table 4.7. Estimated Impacts on Affected Grazing Allotments from the Proposed Action

Allotment and Acreage	Allotment Acreage within Proposed Action Study Area	Estimated Temporary Impact of Productive Rangelands (acres, percentage)	Estimated Long-term Impact of Productive Rangelands (acres, percentage)
Coal Canyon-Poker (97,828)	205	5 (<0.00)	5.1 (0.01)
Rochester (431,784)	8,387	191 (0.04)	209 (0.05)
Rawhide (153,597)	0	0	0
Star Peak (81,356)	0	0	0
Total	**8,592**	**586**	**270**
Source: EMPSi 2012			

4.1.15.1.1. Recommended Mitigation

- TGP shall place escape ramps every 200 linear feet around the perimeter of the sump, that are covered with geo-mesh, that are sloped 3:1 (horizontal:vertical) or flatter and that are at least 8 feet wide each.
- Fencing shall be installed 6-feet from the edges of the berms. Fences shall be 4-strand or chain-link of at least 4 feet high with the bottom 2 feet made of a mesh with holes no greater than two inches.

4.1.15.2. Alternative 1

Alternative 1 would cause temporary disturbance of up to 237 acres, which would be reclaimed, and an additional long-term disturbance of up to 272 acres. Portions of the Alternative 1 Gen-Tie Route occur in steep terrain areas and in playas where productive grazing does not occur. Assuming that 80 percent of the disturbance would occur on productive grazing lands, Alternative 1 would result in a temporary disturbance of 189 acres and a long-term disturbance of 217 acres of productive grazing lands within grazing allotments.

The nature of impacts under Alternative 1 would be the same as those described under the Proposed Action except that the Alternative 1 Gen-Tie would affect different allotments in different acreages than the Proposed Action Gen-Tie line under the Proposed Action. The impact acreages for Alternative 1 are shown in Table 4.8, Estimated Impacts on Affected Grazing Allotments from Alternative 1. Calculations in this analysis were carried out in the same manner as described under the Proposed Action.

Table 4.8. Estimated Impacts on Affected Grazing Allotments from Alternative 1

Allotment and Acreage	Allotment Acreage within Proposed Action Study Area	Estimated Temporary Impact of Productive Rangelands (acres, percentage)	Estimated Long-term Impact of Productive Rangelands (acres, percentage)
Coal Canyon-Poker (97,828)	0	0	0
Rochester (431,784)	8,179	181 (0.04)	201 (0.05)
Rawhide (153,597)	326	7 (<0.01)	8 (0.01)
Star Peak (81,356)	42	3 (<0.01)	1 (<0.01)

Total	8,547	191	217
Source: EMPSi 2012			

Approximately 0.04 percent of productive grazing lands within the Rochester Allotment would be temporary removed from productivity by Alternative 1 and 0.05 percent would be permanently removed. The temporarily disturbed areas would be revegetated after construction operations are complete. No reduction in authorized grazing use would be required.

Other allotments would be affected at levels of 0.01 percent or less, temporarily, and levels of 0.01 percent or less over the long-term. No reduction in authorized grazing use would be required.

4.1.15.2.1. Recommended Mitigation

Recommended mitigation under Alternative 1 would be the same as described for the Proposed Action.

4.1.15.3. No Action Alternative

Under the No Action Alternative, range (livestock grazing) impacts would occur as analyzed in Section 4.14 Range Resources, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.16. Social and Economic Values

Impact indicators would be:

- Number of temporary jobs and over how long.
- Number of long-term jobs and over how long.
- Units of lodging and vacancy rate in Lovelock to accommodate the additional workers.

It is estimated that up to 150 workers would be involved during the 24-month construction of the power plant, production and injection wells, pipelines, access roads and gen-tie, with the onsite workforce ranging between 80 and 100 workers during the initial 12 months. The workforce would peak at about 150 workers from month 13 to month 18, and gradually decrease during the last 6 months of construction. The influx of personnel would create a temporary increase in demand for public and private services. Since most of the employment would be temporary, it is assumed the workforce would relocate to the area temporarily without families. Some of the construction crew would stay in TGP-provided lodging (trailers) within the Geothermal Development Area and the others would likely commute from Lovelock, which is about a one hour drive. As outlined in Section 2.1.8, the on-site lodging would consist of four trailers that would house up to three people in each. Workers may also commute from Fallon but it is unlikely since it is an approximate two-hour one-way commute. Nevertheless, crews could stay within the Geothermal Development Area or in Lovelock during work days and return to Fallon for their days off. It is anticipated that the Town of Lovelock would be able to accommodate the temporary workers due to the high vacancy rates (18.7 percent of all housing units and 20.8 percent of rental units) and the presence of 7 motels and an RV park.

The construction crew would support local business and provide income to the community through the purchase of goods and services, impacting the local economies. In addition, TGP would likely purchase or rent some portion of the equipment and supplies for the project from local suppliers.

Power plant operations would require a permanent workforce of up to 16 professionals in addition to regular maintenance activities supported by outside contractors. This permanent workforce would commute from Fallon via daily air transportation using TGP's contracted Bonanza A36 and from Lovelock using personal vehicles.

The 16 permanent jobs created by this project would contribute to the local economy by bringing stable, well-paying employment opportunities to the area. There would also be a long-term income stream to Pershing County from taxes and revenues associated with the geothermal power plant and the gen-tie line, and additional jobs might be created in the region due to the influx of expenditures on materials needed for the project and from spending by the temporary workforce.

Due to the relatively short-term construction period(two years) of the Proposed Action and the relatively low number of permanent workers, the Proposed Action is not expected to induce population growth in either Churchill or Pershing counties. Additionally, the Proposed Action would not create any infrastructure that would promote substantial population growth.

As discussed in Section 4.1.15, Range Resources, The Proposed Action would cause temporary disturbance of up to 191 acres and a permanent disturbance of up to 217 acres within the Rochester Grazing Allotment, which in total is less than 0.1 percent of the 432,784 acres comprising the allotment. Four other allotments would be impacted to lesser degrees. No reduction in authorized grazing use would be expected and there would be no impacts to the ranching industry.

The area is characterized as a unit with no identifiable market demand for structured recreation opportunities. While there would be the occasional inconvenience of increased traffic caused by development activities associated with the Proposed Action, implementation of the Proposed Action would not prevent continued access by recreational users of the adjacent public lands. Because recreation in the area is so dispersed, no adverse impacts are anticipated from development activities associated with the Proposed Action.

The proposed action would result in visual impacts as discussed in Section 4.1.14, Visual Resources. Because the Project Area and surrounding lands are primarily utilized for off-highway vehicles, hunting, and other dispersed types of recreation that are not dependent upon the scenic quality of the lands, the visual alterations are not likely to influence the recreational use of this area.

As discussed in Section 3.16.3, there is a relatively higher population of American Indian and Alaska Native individuals in the study area, especially in the city of Lovelock. The Fallon Paiute and Shoshone Tribe and the Lovelock Paiute Tribe expressed some concern regarding possible impacts from the Proposed Action. These concerns, the associated impact analysis, and proposed mitigation measures are discussed in Section 4.1.5, Native American Religious Concerns. There is also a relatively higher percentage of people living below the poverty line in Lovelock. These individuals would likely be impacted by the Proposed Action through new employment opportunities and increased spending in the city as a result of the project.

4.1.16.1. Proposed Action

4.1.16.1.1. Recommended Mitigation

No mitigation is recommended.

4.1.16.2. Alternative 1

Impacts under Alternative 1 would be as described under the Proposed Action except for a marginal decrease in impacts on grazing allotments.

4.1.16.2.1. Recommended Mitigation

No mitigation recommended.

4.1.16.3. No Action Alternative

Under the No Action Alternative, impacts related to social and economic values would occur as analyzed in Section 4.9 Economic Values, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.17. Soils

4.1.17.1. Lease Stipulation

- Lease stipulations for all leased areas included in the Proposed Action prohibit surface occupancy, including well pad disturbance or construction, on areas with slopes greater than 40 percent.
- The lease stipulates controlled surface use for the protection of erosive soils and soils on slopes greater than 30 percent. Erosion control measures will be employed on soils with greater than 30 percent slopes and those with severe or very severe erosion classes.
- Wells and roads not required for development purposes will be re-contoured to blend with the surrounding topography, in accordance with lease stipulations.

4.1.17.2. Applicant Proposed Environmental Protection Measures

- BMPs, including development of a Spill Prevention, Control, and Countermeasure plan, would be implemented to prevent the release of hazardous materials to the environment which could affect soil resources.
- The operator will construct sumps and pits adequate, but not larger than proposed use. Operator would also comply with NDEP requirements to minimize sump slopes, which may result in a larger sump area. Topsoil would be salvaged and reused whenever possible and in a timely manner.
- Temporarily disturbed areas will be reseeded where previously vegetated using a BLM approved seed mixture.
- Erosion control measures, including but not limited to silt fencing, diversion ditches, water bars, temporary mulching and seeding, and application of gravel or rip rap, will be installed, where necessary, at the beginning of construction activities to avoid erosion and runoff.

- Access roads will follow existing contours to the maximum extent possible. In areas where new access roads must be constructed across slopes, erosion control measures will be installed as necessary, in accordance with Gold Book standards (BLM 2007).

- An average of six inches of gravel will be used as road surface because roads would be used during all seasons. Up to 3 feet of gravel may be used on some sections of road and no gravel would be used on road sections where the natural surface is adequate.

- Additional gravel will be laid down when ground conditions are wet enough to cause rutting or other noticeable surface deformation and severe compaction. As a general rule, if vehicles or other project equipment create ruts in excess of four inches deep when traveling cross-country over wet soils, the soil shall be deemed too wet for vehicle use, without the application of a gravel surface.

- If construction occurs in areas of very soft soils, up to three feet of aggregate will be used.

- An NDEP-BAPC Surface Area Disturbance permit documenting the best practical management practices to be used will be required for the project because the surface disturbed by the project will be greater than five acres.

4.1.17.3. Proposed Action

Impact indicators would be:

- Acres of Farmland with Statewide Importance that would be disturbed temporarily and taken out of access to farming over the long-term.

- Acres of Prime Farmland if Irrigated and Reclaimed of Excess Salts and Sodium that would be disturbed temporarily and taken out of access to farming over the long-term.

The geothermal power plant, well pads, and pipelines would not be constructed on steep slopes, in compliance with the No Surface Occupancy stipulation for lands with slopes of 40 percent or greater. Some portions of the gen-tie routes would occur in areas of steep slopes. Long-term disturbance related to the gen-tie lines would generally be limited to small areas associated with each gen-tie support structure. Short-term disturbance of soils related to the gen-tie lines would be associated with staging areas and stringing areas; these areas would be disturbed for a few days to a few months and would then be reseeded per BLM guidelines. The locations of these areas would generally be selected to avoid steep slopes since such areas are impractical for the staging and stringing activities.

Section 3.17, Soils, identifies 13 acres of Farmland with Statewide Importance and one acre of Prime Farmland if Irrigated and Reclaimed of Excess Salts and Sodium as being present within the Proposed Action Gen-Tie Route 200-foot wide study corridor. Only a fraction of the land within the study corridor would be disturbed by construction of the Proposed Action Gen-Tie Line. For example, as shown in Section 3.17, Soils, the Proposed Action Gen-Tie study corridor contains 643 acres, but the entire long-term disturbance for the Proposed Action Gen-Tie route is only 13 acres. This disturbance acreage, compared with the total study corridor acreage of 643 represents 2 percent. It can then be assumed that an estimated two percent of the acreage of any given soil type identified in the study corridor would be disturbed. It is estimated that 0.26 acres (2 percent of 13 acres) of Farmland with Statewide Importance would be disturbed and 0.02 acre

(2 percent of 1 acre) of Prime Farmland if Irrigated and Reclaimed of Excess Salts and Sodium would be disturbed by the Proposed Action.

The release of hazardous materials to the environment could affect soil resources. BMPs to prevent such a release, including development of a Spill Prevention, Control, and Countermeasure plan, are described in Section 4.1.7, Wastes, Hazardous or Solid.

4.1.17.3.1. Recommended Mitigation

No mitigation recommended.

4.1.17.4. Alternative 1

The nature and types of impacts under Alternative 1 would be as described for the Proposed Action.

Section 3.17, Soils, identifies 314 acres of Farmland with Statewide Importance as being present within the Alternative 1 Gen-Tie Route 200-foot wide study corridor. An estimated two percent of the acreage of any given soil type identified in the study corridor would be disturbed. It is estimated that 6 acres (2 percent of 314 acres) of Farmland with Statewide Importance would be disturbed by implementation of Alternative 1.

4.1.17.4.1. Recommended Mitigation

No mitigation recommended.

4.1.17.5. No Action Alternative

Under the No Action Alternative, soils impacts would occur as analyzed in Section 4.16 Soils, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.18. Special Status Species

4.1.18.1. Applicant Proposed Environmental Protection Measures

- TGP would contract a BLM-approved biologist to conduct a pre-construction survey of areas to be disturbed within the Lease Area for sand cholla. TGP would avoid any discovered sand cholla to the extent practicable. If a sand cholla needs to be disturbed, it would be transplanted by a BLM-approved biologist or other approved resource specialist to suitable nearby habitat within the Project Area.
- A Bird and Bat Conservation Strategy/Eagle Conservation Plan has been prepared and is being reviewed by the US Fish and Wildlife Service. TGP would comply with all protective measures included in the finalized version of the plan that has been approved by the US Fish and Wildlife Service. (By policy, this approval is necessary prior to the BLM issuing a decision on this project). TGP commits to the protective measures included in this draft version of the plan. These measures are considered part of the Proposed Action:

- Structures would be constructed to conform to those practices described in Suggested Practices for Raptor Protection on Power Lines (APLIC 2006).
- TGP will install bird flight diverters (visual markers) on gen-tie lines in areas with concentrations of raptors or other migrating birds to prevent mid-flight collisions. The number and color configurations would be determined in coordination with the BLM and NDOW. TGP would maintain or replace diverters as needed for the life of the project.
- TGP will install perch-deterrent devices on all transmission structures within three miles of greater sage-grouse habitat to reduce raptor and corvid (ravens, etc.) use. The ultimate location in the application area will be determined in coordination with the BLM and NDOW.
- TGP will use lighting directed downward onto the site only and away from adjacent areas. TGP will utilize lighting that is hooded and shielded for all lighting associated with the project, so as not to allow the bulb to shine up or out, with the exception of vehicle headlamps and lighting required by the Federal Aviation Administration.
- TGP would avoid to the extent practicable any construction activities within 200 yards of identified bat colonies during the bat hibernation season of September 15th through April 30th.
- Wells and roads would be recontoured and reseeded following completion of the Proposed Action. Erosion-control measures would be implemented and topsoil would be salvaged and reused whenever possible and in a timely manner.
- Surface-disturbing activities during the migratory bird nesting season (April through July) may be restricted in order to avoid potential violation of the Migratory Bird Treaty Act.
- TGP would conduct a pre-construction burrowing owl survey and nesting bird survey. If any active nests are found in proximity to work areas, a buffer zone would be established around the nest and work would be avoided in this area until after young have fledged.
- The MBTA and stipulations of the geothermal leases held by TGP address requirements related to ground-disturbing activities during the migratory bird nesting season. In order to meet these requirements, either habitat for migratory birds would be eliminated within areas of proposed disturbance prior to the nesting season, or migratory bird nest surveys would be conducted no more than two weeks prior to surface disturbing activities by a qualified biologist acceptable to the BLM. 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, TGP would coordinate with the BLM to develop appropriate protection measures for these sites, which may include avoidance, construction constraints, and the establishment of buffers.
- Use existing roads to the extent possible.
- Avoid construction designs (including structures such as meteorological towers) that increase the risk of collision, such as guy wires. If guy wires are used, mark them with bird flight diverters (according to the manufacturer's recommendation).
- Personnel will be trained to be alert for wildlife at all times, especially during low visibility conditions.

- Personnel, contractors, and visitors will be instructed to avoid disturbing wildlife, especially during the breeding seasons and seasonal periods of stress.

4.1.18.2. Proposed Action

Impact indicators would be:

- Acres of habitat for special status species that would be removed temporarily and over the long-term.
- The presence of project features that could injure or kill special status species.
- The proximity of activities to special status species habitat that could be disturbed by project-generated noise.

4.1.18.2.1. Geothermal Development Project Area

No federally listed endangered or threatened species inhabit the Geothermal Development Area (USFWS 2011). However, several BLM sensitive species have the potential to inhabit the Geothermal Development Area (Table 3.8). Construction of the power plant would cause the direct and permanent removal of 60 acres of potential special status species habitat. As described above, additional habitat fragmentation and behavioral effects may occur as a result of the noise created during the construction and operation of the Proposed Project.

4.1.18.2.1.1. Special Status Plants

The construction of the Proposed Action could remove or degrade potential habitat and possibly destroy populations of rare plants. Pre-construction surveys would be conducted for any BLM sensitive plant species, including sand cholla and Lahontan beardtongue. Any BLM sensitive plant not able to be avoided during construction of the proposed action would be transplanted. Therefore, impacts on BLM-sensitive plant species would be mitigated. Mitigation for the protection of sand cholla is presented below and in Section 2.1.11, Environmental Protection Measures.

4.1.18.2.1.2. Wildlife

The effects on BLM sensitive wildlife species from the construction and operation of the Proposed Action would be similar to those described in Section 4.1.23, Wildlife.

4.1.18.2.1.3. Birds

The effects on BLM sensitive bird species from the construction and operation of the Proposed Action would be same as described in Section 4.1.4, Migratory Birds.

4.1.18.2.1.4. Golden Eagle

Impacts on Golden eagles from this project within the Geothermal Development Area come primarily from the risk of collision with disturbance from noise during construction, as discussed in Section 4.1.4, Migratory Birds. Construction noise may disturb nesting golden eagles in the vicinity of the project, resulting in nest abandonment. Construction noise would be greatest near

construction sites (up to 95 dBA at 50 feet) and attenuate outward from there by 6 dBA for every doubling of distance. Figure 18 shows the anticipated noise levels used for impact analysis on golden eagle nesting sites and bat hibernation locations. Heavy equipment used to prepare access roads, the power plant, wells, pipeline supports and pole locations would generate noise up to 95 dBA at 50 feet. Figure 19 includes only the East power plant location since this is the site closest to identified eagle nests. Figure 19 also includes the maximum sound level that would be experienced across the project vicinity during takeoff and landings at the airstrip. Table 4.9, Number of Golden Eagle Nests at Specified Levels of Construction Noise for the Proposed Action, shows the number of golden eagle nest sites at each noise contour level.

Table 4.9. Number of Golden Eagle Nests at Specified Levels of Construction Noise for the Proposed Action

Noise Level (dBA) and Distance (feet)	Inactive Nest	Active Nest	Occupied Nest
89 (within 100)	0	0	0
83 (within 200)	0	0	0
77 (within 400)	0	0	0
71 (within 800)	0	0	0
65 (within 1,600)	0	0	0
59 (within 3,200)	1	0	0
53 (within 6,400)	1	0	0
47 (within 12,800)	7	3	0
41 (within 25,600)	3	6	2

Given the distance of the project from eagle nests (greater than 0.5 miles), the estimated maximum noise levels at nesting sites (40 to 60 dBA, see Table 4.9), and the high ambient background noise in the area, it is unlikely that eagles would experience substantial disturbance from project noise at nesting sites.

4.1.18.2.1.5. Bats

Lighting at plant facilities could attract insects and foraging bats, but with appropriate lighting design this is unlikely to result in mortality to bats.

4.1.18.2.1.6. Greater Sage-Grouse

Development within the Geothermal Development Area is unlikely to have impacts on Sage-grouse habitat given that only low value habitat is present at a distance of four miles to the south of the Project Area.

4.1.18.2.2. Proposed Action Gen-Tie Route Project Area

The Proposed Action Gen-Tie Line would be approximately 26 miles long. The construction of the line would result in the temporary disturbance of approximately 102 acres of potential special status species habitat and a permanent disturbance of approximately 13 acres.

4.1.18.2.2.1. Golden Eagle

Noise from construction of the gen-tie route could impact eagles in the same way that construction within the Geothermal Development Area could impact eagles, as described above. Construction

noise would be greatest near construction sites (up to 95 dBA at 50 feet) and attenuate outward from there by 6 dBA for every doubling of distance.. The 196 support structures would be constructed over a period of 13 months, equating to approximately 2 days of work time per structure. Within those 2 days, those sound levels would only be experienced for a portion of that time, during the noisiest aspects of site preparation. In addition, although electrocution risk can be avoided by properly constructing power lines, collision is also a threat to birds. In 2000 and 2001, ten percent of documented golden eagle mortality from collision with small distribution power lines associated with oil and gas wells in central Montana was attributed to mid-span collisions (USFWS 2009). Electrocution of birds attempting to use these structures for perching and nesting would not occur since the gen-tie would be constructed per Avian Power Line Interaction Committee guidelines (Avian Power Line Interaction Committee 2006).

Golden eagles are relatively common in the Project Area, with 0.9 eagles viewed per survey hour. However, unlike wind projects where individual turbines each pose a collision risk to eagles in the area, transmission lines occupy less space and can be made visible, reducing potential risks to eagles. Furthermore, electrocution of birds is unlikely from newer constructed transmission lines that use avian-safe practices. Likewise, 230-kV transmission lines do not pose a threat via electrocution due to the distance between the conductor lines and/or ground lines. These spans are greater than six feet, which is the average wing span of a golden eagle. Thus, no eagles are likely to be electrocuted.

In order to comply with the Bald and Golden Eagle Protection Act and BLM's IM 2010-156, a Bird and Bat Conservation Strategy and Eagle Conservation Plan is being developed in consultation with the USFWS to reduce the risk of take for golden eagles and to reduce the likelihood of population-level impacts.

4.1.18.2.2.2. Bats

Construction noise may disturb roosting or hibernating bats in the vicinity of the project, resulting in roost abandonment or disruption of hibernation. Construction noise would be greatest near the construction site and attenuate outward from there. Seven bat hibernation locations have been documented within 200 yards of the Proposed Action Gen-Tie route survey corridor (EMPSi 2012), and several other adits were observed that may serve as additional roost sites. Construction noise could cause hibernating bats within 200 yards to wake prematurely from their hibernation and/or leave their hibernation locations. Waking prematurely from hibernation could cause bats to deplete energy reserves needed to survive until spring and could result in starvation.

Table 4.10, Bat Hibernation Sites and Mine Entrances at Specified Levels of Construction Noise for the Proposed Action, shows the number of bat roosts and hibernation locations within each noise contour shown in Figure 18 and Figure 19. Although there are four candidate power plant locations, the East power plant location was selected for this analysis since the tie-line options for that plant site would come closer to the main cluster of bat roosts and hibernation locations than the other candidate plant sites. The 4 adits that are within the 77, 83, and 89 dBA noise contours, and the 4 hibernation sites that are within the 77 dBA noise contour are all within 200 yards of the Proposed Action Gen-Tie 200-foot right of way, as are 4 of 6 adits and 3 out of 4 hibernation sites in the 71 dBA noise contour. The remaining adits and hibernation sites are farther than 200 yards (600 feet) from the Proposed Action Gen-Tie 200-foot right-of-way.

No data on bat sensitivity to noise were available; however, the location of known hibernation sites within 200 yards of the project components in the 71 and 77 dBA contours indicates bats at 7 different hibernation sites could be disturbed (see discussion in Section 4.1.4, Migratory Birds).

Table 4.10. Bat Hibernation Sites and Mine Entrances at Specified Levels of Construction Noise for the Proposed Action

Noise Level (dBA)	Adits and mineshafts and distance (feet)	Hibernation locations
89	1 (within 100)	0
83	2 (within 200)	0
77	1 (within 400)	4
71	6 (within 800)	4
65	13 (within 1,600)	1
59	7 (within 3,200)	1
53	2 (within 6,400)	0

In response to this concern, TGP has committed to a bat protection measure, described above and in Section 2.1.11, Environmental Protection Measures. This measure would reduce the likelihood of impacts on bats; however disturbance of hibernating colonies could still occur.

Bat electrocution from power lines is considered unlikely given their short wingspans of less than 18 inches and the separation of electrified components of the power lines of 6 feet.

4.1.18.2.2.3. Sage-Grouse

While no sage-grouse habitat was observed within the Project Area, Preliminary General Habitat is documented within four miles of the Proposed Action Gen-Tie Route and Low Value habitat within half a mile of the route. Given the distance to Preliminary General Habitat, no impacts to sage grouse are anticipated and no anti-perch devices would be required.

4.1.18.2.3. Recommended Mitigation

- During development and production phases, artificial ponds will be fitted with floating balls. (To prevent birds and bats from becoming entrained in netting, netting shall not be used.) Floating balls shall be installed in numbers that cover maximum fluid surface area at maximum allowable freeboard.
- TGP shall avoid any construction activities within 200 yards of bat hibernation locations during bat hibernation season of September 15th to April 30th.

4.1.18.3. Alternative 1

Impacts from construction and operation of project components within the Geothermal Development Area would be the same as described above under Proposed Action. Impacts from construction and operation of the Alternative 1 Gen-Tie would be slightly less than under the Proposed Action due to the slightly reduced acreage of disturbance and associated habitat loss, and due to the avoidance of the cluster of mineshafts and adits containing bat populations.

Table 4.11, Number of Golden Eagle Nests at Specified Levels of Construction Noise for Alternative 1, shows the number of golden eagle nest sites at each noise contour level.

Table 4.11. Number of Golden Eagle Nests at Specified Levels of Construction Noise for Alternative 1

Noise Level (dBA) and Distance (feet)	Inactive Nest	Active Nest	Occupied Nest
89 (within 100)	0	0	0
83 (within 200)	0	0	0
77 (within 400)	0	0	0
71 (within 800)	0	0	0
65 (within 1,600)	0	0	0
59 (within 3,200)	0	0	0
53 (within 6,400)	0	0	0
47 (within 12,800)	3	1	0
41 (within 25,600)	3	3	1

Given the distance of the project from eagle nests (greater than 1 mile), the estimated maximum noise levels at nesting sites (40 to 47 dBA, see Table 4.11), and the high ambient background noise in the area, it is unlikely that eagles would experience substantial disturbance from project noise at nesting sites.

No bat hibernation locations were identified within several miles of the Alternative 1 Project Area. One mineshaft/adit is located within the Geothermal Development Area but this site has not been identified as a hibernation location. No impacts on bats are expected to result from Alternative 1.

Bat electrocution from power lines is considered unlikely given their short wingspans of less than 18 inches and the separation of electrified components of the power lines of 6 feet.

While no sage-grouse habitat was observed within the Project Area, Preliminary General Habitat is documented within four miles of the Alternative 1 Action Gen-Tie Route and Low Value habitat within half a mile of the route. Given the distance to Preliminary General Habitat, no impacts to sage grouse are anticipated and no anti-perch devices would be required.

4.1.18.3.1. Recommended Mitigation

- During development and production phases, artificial ponds will be fitted with floating balls. (To prevent birds and bats from becoming entrained in netting, netting shall not be

  used.) Floating balls shall be installed in numbers that cover maximum fluid surface area at maximum allowable freeboard.

4.1.18.4. No Action Alternative

Under the No Action Alternative, impacts on special status species would occur as analyzed in Section 4.17 Special-Status Species, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.19. Vegetation

4.1.19.1. Lease Stipulation

- Wells and roads not required for development purposes will be re-contoured to blend with the surrounding topography and using appropriate methods to seed with diverse perennial "certified" weed free seed mix.

4.1.19.2. Applicant Proposed Environmental Protection Measures

- The BLM-approved seed mixtures as shown in Table 2.11, Proposed Seed Mix, would be used.
- TGP would consult with BLM regarding the timing of reseeding, specific seed mixtures, and application rates to be used to improve the success of reseeding.
- Disturbed areas would be re-contoured to blend with the surrounding topography. Topsoil would be salvaged whenever possible and reused in a timely manner.
- Impacts on vegetation would be minimized by reseeding all areas of access roads and well pads not required for subsequent energy production using weed-free and BLM-approved seed mixtures.

4.1.19.3. Proposed Action

- The number of acres of various types of vegetation that would be disturbed temporarily and over the long-term.

4.1.19.3.1. Geothermal Development Area and Gravel Extraction

The construction of the power plant, pipelines, airfield, and access roads, as well as the extraction of gravel, which may or may not be within the Geothermal Development Area, would cause a temporary disturbance of 142 acres of vegetation, and an additional 255 acres would be disturbed or removed permanently. The area of disturbance would occur primarily in the Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Big Sagebrush Shrubland vegetation communities. Several other vegetation communities would also be disturbed but to a lesser extent. See Table 3.10 for an overview of vegetation types present within Geothermal Development Area. Temporary impacts would be reduced by implementation of the environmental protection measures described in Section 2.1.11, Environmental Protection Measures. Indirect effects of vegetation removal include the potential for the introduction or spread of invasive nonnative species (see Section 4.1.3, Invasive, Non-Native Species), erosion, and loss of soil productivity (see Section 4.1.17, Soils).

Vehicles traveling to and from the construction sites would increase the amount of dust in the air. Dust may affect photosynthesis, respiration, and transpiration and allow the penetration of phytotoxic gaseous pollutants. Visible injury symptoms may occur, and generally there would be decreased productivity (Farmer 1993). However applying gravel to the roads and enforcing a speed limit of 25 miles per hour, as committed to by TGP in Section 2.1.11, Environmental Protection Measures, would minimize the dust in the air and its effect on nearby vegetation.

Impacts on vegetation from operation would be less than those caused by construction activities. However, vehicles traveling to and from the power plant would increase dust in the air, and impacts would occur as described for construction.

4.1.19.3.1.1. Potential Power Plant Location - North

The construction of the power plant in the North location would create a permanent disturbance of approximately 51 acres within the Inter-Mountain Basins Mixed Salt Desert Scrub vegetation community and approximately nine acres within invasive shrubland, forbland, or grassland. In total, the proposed North Power Plant option would temporarily disturb zero acres of vegetation and permanently disturb 60 acres of vegetation.

4.1.19.3.1.2. Potential Power Plant Location - East

The construction of the power plant in the East location would create a permanent disturbance of approximately 60 acres within the Inter-Mountain Basins Mixed Salt Desert Scrub vegetation community. In total, the proposed East Power Plant option would temporarily disturb zero acres of vegetation and permanently disturb 60 acres of vegetation.

4.1.19.3.1.3. Potential Power Plant Location - Central

The construction of the power plant in the Central location would create a permanent disturbance of approximately 58 acres within the Inter-Mountain Basins Mixed Salt Desert Scrub vegetation community and approximately 2 acres within inter-mountain basins semi-desert shrub steppe. In total, the proposed Central Power Plant option would temporarily disturb zero acres of vegetation and permanently disturb 60 acres of vegetation.

4.1.19.3.1.4. Potential Power Plant Location - South

The vegetation disturbance caused by the proposed construction of the power plant in the South location would be the same as described above for Potential Power Plant Location – East.

4.1.19.3.2. Proposed Action Gen-Tie Route Project Area

The Proposed Action Gen-Tie Line would be approximately 26 miles long, the construction of which would result in the temporary loss of approximately 102 acres of vegetation and a permanent loss of approximately 13 acres. Exact acreages of disturbance by vegetation type are not able to be calculated at this time, as the actual locations of gen-tie support structures and other components would not be finalized until detailed project design. However, the majority of this disturbance would occur in the Inter-Mountain Basins Mixed Salt Desert Scrub vegetation community.

4.1.19.3.3. Recommended Mitigation

- Any graveled areas not identified for development within two years shall be topsoiled and seeded as described in Section 2.1.1.12 Restoration and Reclamation.

4.1.19.4. Alternative 1

Within the Geothermal Development Area, impacts under Alternative 1 would be as described for the Proposed Action. The Alternative 1 Gen-Tie Route would be two miles shorter than the Proposed Action Gen-Tie Route but would require the construction of a new five-acre substation at the interconnect point. The Alternative 1 Gen-Tie Route would result in temporary vegetation loss of 94 acres and a permanent vegetation loss of 12 acres.

4.1.19.4.1. Recommended Mitigation

No mitigation recommended.

4.1.19.5. No Action Alternative

Under the No Action Alternative, vegetation impacts would occur as analyzed in Section 4.18 Vegetation, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.20. Visual Resources

4.1.20.1. Applicant Proposed Environmental Protection Measures

To minimize the potential for impacts on visual resources from the Proposed Action, TGP would implement the following measures:

- To minimize the visibility of project features, the power plant, pipelines, and well heads will be painted a color that blends with the surrounding area, as approved by the BLM.
- To avoid light pollution onto adjacent areas as viewed from a distance, TGP will utilize lighting directed downward on to the site only and away from adjacent areas. TGP will utilize lighting that is hooded and shielded for all lighting associated with the project so as not to allow the bulb to shine up or out with the exception of vehicle headlamps and lighting required by Federal Aviation Association.
- TGP would install aerial marker balls on portions of any installed transmission line identified by Naval Air Station Fallon as an area of frequent low altitude overflights. Aerial marker balls would allow the power lines to be visible to aircraft pilots and minimize collision risk.

4.1.20.2. Proposed Action

The impact indicator would be:

- Whether the Proposed Action is consistent or not with the designated Visual Resources Management class of the Project Area.
- Whether the Proposed Action would generate light that would either shine directly or be reflected up into the sky.
- Whether the Proposed Action would result in light spilling over onto adjacent lands outside of the Project Area.

Gravel excavation, drilling, construction, and permanent project features would add line, form, color, and texture contrasts to the existing landscape. These changes would be consistent with the BLM Visual Resources Management Class IV of these lands. The small portion of the Proposed Action Gen-Tie Line that would be constructed within or near Class III lands would also be consistent with that designation.

Portions of the gen-tie lines that cross Navy flight paths may pose a hazard to low flying aircraft. TGP has been in communication with the Navy about the proposed project and has agreed to the mitigation measure identified below and in Section 2.1.11, Environmental Protection Measures. A letter from TGP to Naval Air Station Fallon, presenting a summary of a preceding meeting between the two parties, is presented in Appendix F (*Appendices are available for download from the project website under "Documents"*).

Implementation of the Proposed Action would introduce new light sources to the Buena Vista Valley, potentially reducing the darkness of night skies and landscapes that are currently present in the area. The Federal Aviation Administration may require lighting to be installed on drill rig masts to improve visibility for aircraft crossing the area at night. The visual impact would be limited to nighttime and limited to the drilling phase of the project.

4.1.20.2.1. Recommended Mitigation

- Construction of all facilities would utilize screening on proposed stationary lights and light plants. Lighting would be directed onto the pertinent site only and away from adjacent areas not in use with safety and proper lighting of the active work areas being the primary goal. Lighting fixtures would be hooded and shielded as appropriate.

4.1.20.3. Alternative 1

Visual impacts would be slightly less under Alternative 1 than under the Proposed Action because no part of the project would be constructed within or near Visual Resource Management Class III lands.

4.1.20.3.1. Recommended Mitigation

- Construction of all facilities would utilize screening on proposed stationary lights and light plants. Lighting would be directed onto the pertinent site only and away from adjacent areas not in use with safety and proper lighting of the active work areas being the primary goal. Lighting fixtures would be hooded and shielded as appropriate.

4.1.20.4. No Action Alternative

Under the No Action Alternative, impacts on visual resources would occur as analyzed in Section 4.19 Visual Resources, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.21. Water Quantity

4.1.21.1. Proposed Action

Impact indicators would be:

- Withdrawal of groundwater in an aquifer that is already over allocated.
- Use of surface water in a volume that would reduce water availability for other users.
- Drawdown of local aquifers.
- Loss of available water for other water right users.

Over the 2-year construction period, approximately 20 million gallons of water would be needed for well drilling and all construction activities. As stated in Section 2.1.5, TGP would secure water rights through new appropriations or through entering into long-term water supply agreements with local ranchers who already have water rights. Bulk bottled water would be provided to construction workers for drinking water, and portable toilets would be used during construction.

TGP applied to the NDWR for a groundwater right of up to 550 AFY for various power plant uses during operations. As of this time of writing, the permit application has gone through the public notice period without protest and became ready for action by NDWR on June 9, 2012. TGP would drill a water well in the Project Area to an estimated depth of about 500 feet under a pending Application to Appropriate with the NDWR. This well water would be used for the domestic water system (except for drinking water, which would be provided from bottled water.) Pumping groundwater from the 500-foot water supply well at an average rate of 340 gpm is expected to have no adverse impact on flows from springs in the Project Area because the source for springs is likely recharge of precipitation to shallow groundwater in the mountains. The pumping well could lower water levels in existing wells in the Project Area if the wells are within the pumping well's zone of influence (i.e., cone-of-depression). The water resources monitoring program, described below, would determine if such impacts are occurring during operations. Based on a review of NDEP (2012) information, there are no designated source water protection areas, or wellhead protection plans, in Project Area.

In addition for the water consumption that would occur if wet cooling were selected as the cooling technology, additional water would be lost to evaporation if a flash or combined technology plant technology were selected. As identified in Section 2.1.2.3, 85 to 100 percent of flashed fluids would be cooled and recondensed for injection back into the geothermal reservoir. This leaves up to 15 percent of fluids that could be lost to evaporation from the cooling tower. At an annual flow of 19,400 acre-feet and a maximum evaporation factor of 15 percent, up to 2,910 acre feet could be lost to evaporation per year from the geothermal reservoir. Over a theoretical 30 year lifespan of the power plant, 87,300 acre feet could be permanently withdrawn from the geothermal reservoir from evaporation alone. TGP would need to acquire water rights for underground geothermal consumptive use from the Nevada State Engineer. These rights would be applied for once TGP knows the location of the proposed geothermal wells.

4.1.21.1.1. Recommended Mitigation

No mitigation is recommended.

4.1.21.2. Alternative 1

Impacts under Alternative 1 would be the same as under the Proposed Action.

4.1.21.2.1. Recommended Mitigation

No mitigation recommended.

4.1.21.3. No Action Alternative

Under the No Action Alternative, water quantity impacts would occur as analyzed in Section 4.8 Water Quality (Surface and Ground) and Water Quantity, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.22. Wild Horse Management

4.1.22.1. Applicant Proposed Environmental Protection Measures

- TGP would underground segments of the pipeline in areas to facilitate wild horse passage. TGP would locate these undergrounded segments wherever a wild horse trail is identified up to every mile. Each buried segment would be at least 20 feet in length. Particular focus would be placed on maintaining access to Kitten Springs and Logan Spring. Locations would be developed in coordination with the BLM.
- TGP would ensure that its employees and all contractors are aware that it is illegal to chase or harass wild horses per the Wild Free Roaming Horse and Burro Act of 1971.

4.1.22.2. Proposed Action

Impact indicators would include:

- The number of acres of lands taken out of foraging from herd management areas and the percentage of total acreage of said areas; and
- The degree to which the Proposed Action would obstruct existing trails and access to water sources and foraging areas.

Approximately 59 acres (0.03 percent) of the North Stillwater HMA would be temporarily disturbed. Approximately 235 acres (0.13 percent) of the HMA would be permanently disturbed and removed from foraging habitat as a result of implementing the Proposed Action. Individual well heads and sumps would be fenced off to protect animals from burns, drowning, and from being able to drink brine contained in the sumps. The entire 60-acre power plant complex would also be fenced off.

Construction, human activity, and increased noise in the area from construction and drilling could temporarily displace wild horses from the area. However, most (approximately 85 percent) of the HMA is located outside of the Lease Area. Areas of disturbance would not be located near any springs or watering holes that attract wild horses. Wild horses would likely return to the area after construction.

The Proposed Action would increase the long-term disturbance to wild horses due to heightened awareness of human presence in all phases of project. Project pipelines would be sufficiently wide to present a barrier to wild horses. Pipelines may form obstructions to some familiar access routes and result in an increase in the distances needed to be traveled to water sources and foraging areas. This obstruction could possibly mean horses would no longer utilize such areas and could result in decreased accessibility to food and water. This impact would be reduced since passage would be afforded around the pipelines where they are buried under roads and at other designated locations as identified earlier as an Applicant-Proposed Environmental Protection Measure. Per this measure, in coordination with the BLM, TGP would bury sections of the line at least 20-feet long where prominent trails are identified, up to a frequency of every mile. While the pipelines would not cut off access to any potential forage lands, wild horses may learn to navigate around the structures just as they learn to navigate around natural topographic barriers such as ravines and rock outcroppings.

Aircraft landings and takeoffs could cause distress to nearby wild horses. Aircraft would be restricted to the designated flight path that would be aligned with the orientation of the air strip.

4.1.22.2.1. Recommended Mitigation

No mitigation is recommended.

4.1.22.3. Alternative 1

Impacts under Alternative 1 would be the same as under the Proposed Action.

4.1.22.3.1. Recommended Mitigation

No mitigation recommended.

4.1.22.4. No Action Alternative

Under the No Action Alternative, impacts on wild horse management would occur as analyzed in Section 4.20 Wild Horse Management, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.1.23. Wildlife

4.1.23.1. Proposed Action

Impact indicators would be:

- Acres of habitat for wildlife that would be removed temporarily and over the long-term.
- The presence of project features that could injure or kill wildlife.
- The proximity of activities to specific wildlife habitat features that could be disturbed by project-generated noise.

The construction of the Proposed Action, including power plants, pipeline, the airfield, access roads, and well pads, would cause a temporary disturbance of 142 acres of wildlife habitat. An additional 255 acres would be disturbed or removed permanently. Habitat loss from disturbance and fragmentation may encompass a larger area for some species. Construction could cause injury or mortality to smaller, less-mobile species, as well as lizards and small mammals that forage or have burrow complexes within the greasewood and salt desert scrub habitats. Indirect effects from noise, human presence, and heavy equipment present during construction activities may lead to reduced foraging and breeding success for individuals displaced into surrounding areas. These impacts are expected to lasting the two-year duration of the proposed construction and drilling activities. Wildlife would be able to return to the disturbed areas upon completion of ground-disturbing activities. Individuals that are not displaced during construction, or individuals that return to the site after construction, could be affected by the fragmentation caused by the overall footprint of the project, causing reduced breeding success and increased susceptibility to predator or disease. This in turn could affect the distribution of large mammals and raptors that forage on rodents and small mammals.

Direct and indirect effects of permanent noise associated with a power plant operation would be similar to those described in Section 3.4, Migratory Birds. In general, noise disturbance affects species differently. For example, bats (e.g., pallid bat) that locate prey based on auditory cues instead of echolocation have been shown to avoid noisy areas (Barber et al. 2009a). Bats using echolocation were unaffected because they use ultrasonic signals that are above the spectrum of human noise. 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. 2009b). Noise may cause big game species to avoid the area when traveling between mountain ranges. It is possible that wildlife would either avoid areas directly adjacent to the power plant or would acclimate to the low level noise.

Within the Geothermal Development Area, well pads would be fenced once drilling activities have been completed and a well has been moved into production. During drilling, sumps are are typically enclosed only on three sides by a 3-to-4 foot high single wire fence to exclude entry by humans and livestock. During this time period, wildlife may enter the sumps, become entrapped, and potentially drown. Sumps would be left unlined to prevent mammals from getting their hooves stuck in synthetic liners that are otherwise often used in sumps.

Once drilling is complete, the sumps associated with each well pad would be fenced. Fencing around well pads and the power plant area would exclude terrestrial wildlife from using much of the lands where habitat has been removed, particularly the well pads and the power plant location. Fencing would largely protect terrestrial wildlife from entering the sumps, but the attraction of the water in the sumps can cause some wildlife to break the barrier and still become entrapped.

Pipelines transporting geothermal fluids are also likely to obstruct the movement of large mammals, requiring these species to redirect their movements around the well field.

Because of the minimal areal extent of noise effects from the power plant, the low decibels emanating from the pipeline pumps, and the small habitat acreage lost population viability for any one species is not expected to be reduced as a result of the components of the Proposed Action. Additionally, game species would not reasonably incur additional physiological stress leading to decreased survival by avoiding the Project Area when crossing between mountain ranges.

Facilities with standing water including artificial ponds or sumps associated with each well pad would create an increased risk of insect disease spread or toxicity to wildlife as well as an increased potential for wildlife to drown.

Acreages of disturbance and habitat removal, both temporary and permanent, are provided under Section 4.1.19, Vegetation.

Gen-tie lines provide additional perches for predatory birds, such as raptors and corvids. This increase in perches correlates with an increased predation on prey species such as smaller birds and small mammals.

4.1.23.1.1. Recommended Mitigation

- TGP shall place escape ramps every 200 linear feet around the perimeter of the sump, that are covered with geo-mesh, that are sloped 3:1 (horizontal:vertical) or flatter and that are at least 8 feet wide each.
- Fencing shall be installed 6-feet from the edges of the berms. Fences shall be 4-strand or chain-link of at least 4 feet high with the bottom 2 feet made of a mesh with holes no greater than two inches.

4.1.23.2. Alternative 1

The nature and type of disturbance caused by the construction of the Alternative 1 Gen-Tie Route would be the same as described for the Proposed Action Gen-Tie Route. The Alternative 1 Gen-Tie Line would be two miles shorter than the Proposed Action Gen-Tie line, although it would require the construction of a new five-acre substation at the interconnect point. Overall, the Alternative 1 Gen-Tie Route would likely cause fewer impacts on wildlife compared to the Proposed Action Gen-Tie Route due to a slight decrease in disturbance acreage and habitat loss.

4.1.23.2.1. Recommended Mitigation

Recommended mitigation under Alternative 1 would be the same as described for the Proposed Action.

4.1.23.3. No Action Alternative

Under the No Action Alternative, wildlife impacts would occur as analyzed in Section 4.21 Wildlife Resources, of the Exploration EA (DOI-BLM-NV-W010-2010-0004-EA).

4.2. Cumulative Impacts

The Council on Environmental Quality regulations that implement NEPA defines a cumulative impact as: “The impact on the environment which results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions.” Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

4.2.1. Assumptions for Cumulative Analysis

For the purposes of this analysis, two cumulative impact assessment areas (CIAAs) were defined as discussed below.

For impacts on biological resources, the Biological Resources CIAA is used. The Biological Resources CIAA is shown in Figure 22, Biological Resources CIAA, and is defined as an area that includes:

- The area that was surveyed using a helicopter for golden eagle nests along the three potential gen-tie lines and the Geothermal Development Area;
- Mule deer crucial winter habitat and agriculture habitat;
- Bighorn habitat on the Stillwater Range from McKinney Pass down to Fondaway Canyon.

The Biological Resources CIAA consists of approximately 574,900 acres of which about 409,000 acres are public lands, and 165,000 acres are private lands.

The Cultural Resources CIAA consists of the Project Area, including the Geothermal Development Area and the gen-tie routes proposed under both the Proposed Action and Alternative 1.

The Native American CIAA consists of the Native American Assessment Area, as shown in Figure 11.

For all other resources, the General CIAA is used. The General CIAA is shown in Figure 23, General CIAA, and is defined by the groundwater basins that are overlain by the Project Area. These basins include:

- Buena Vista Valley;
- Lovelock Valley;
- Carson Desert; and
- Dixie Valley.

The General CIAA consists of approximately 2,769,400 acres of which about 1,699,900 acres are public lands, and 534,700 acres are private lands. The Water Quantity CIAA is defined as a subset of this General CIAA and is defined as the Buena Vista groundwater basin 129.

4.2.2. Past and Present Actions

Based on consultation with the BLM Humboldt River Field Office, scoping with agencies and area land users, a review of master title plats within a 0.5 mile buffer of all project components, and current agency GIS records and analysis, the following past and present actions, which have impacted the assessment area to varying degrees, have been identified:

- Mining - Small mMining operations occur throughout the CIAAs with larger scale mining operations being the Relief Canyon Mine and the NV Iron Minethe most notable operations being

- The Relief Canyon Mine site, which occurs within close proximity to the Proposed Action Gen-Tie Route; in fact,. the The Proposed Action Gen-Tie line would cross over some proposed features of the Relief Canyon mine, as described in Section 3.12, Lands and Realty. Relief Canyon is an active mine with ongoing operations.
- The Nevada Iron Mine, which is located several miles south of the Proposed Action Gen-Tie Route.
- The Coeur Rochester mine, which is located 13 miles north of the Lease Area. The former mine was proposing to expand mine operations in 2011 for a period of 6 years.
- The Fencemaker Antimony Mine, which is located approximately half a mile east of the Lease Area.

- Livestock grazing has taken place across the CIAA for many years.
- The Department of Defense conducts testing of low-level supersonic flight operations in the Stillwater Range and southward
- Fires – The BLM has fire history GIS data available from 1980 through year 2007. The area burned by these fires within the General CIAA totals 170,288 acres.
- Right of Ways - Numerous active ROWs occur within the Geothermal Development Area and parallel or intersect the gen-tie routes. These ROWs are for telecommunications, power transmission lines, pipelines, and irrigation.
- Christmas Tree cutting and wood cutting
- Dispersed recreation
- The BLM Humboldt River Field Office has permitted TGP to implement the New York Canyon Geothermal Exploration Project. The project would drill up to 15 geothermal exploration wells that would be supported through the construction of 15 well pads and over 47,000 feet of access roads, with a total disturbance of 82 acres within the Lease Area. The exploration project is expected to be implemented in the 2013-2014 timeframe. Exploration activities may overlap to some degree with the Proposed Action.

4.2.3. Reasonably Foreseeable Future Actions

Reasonably foreseeable future actions are those actions that are known or could reasonably be anticipated to occur within the study area and within a time frame appropriate to the expected impacts from the Proposed Action. For this project, the time frame for potential future actions is assumed to be the lease duration, or approximately 35 years.

Existing grazing and mining operations are expected to continue throughout the CIAAs. Over the 35 year projected period, it is expected that the military will continue its training activities. Fires are expected to continue to burn, particularly with a climate moving toward hotter and drier conditions across Nevada.

Travis Air Force Base is proposing to initiate low level navigation training for C-17 aircrews on Instrument Routes, one of which, IR-281, overlies the Project Area. This proposal would involve use of the route 111 times per year, or 9.26 times per month. About 75 percent of the flights

would occur during daytime (i.e., 7:00 a.m. to 10:00 p.m.) and 25 percent would occur during environmental nighttime (i.e., 10:00 p.m. to 7:00 a.m.). Altitude of these flights would be 300 feet above ground level (Department of Air Force 2012).

In October 2011, proposals by Nevada Iron LLC and NV Energy to construct a buried slurry pipeline, a return water pipeline, and an electrical transmission line that cross the Proposed Action Gen-Tie Route. The location of this potential intersect is described in Section 3.12, Lands and Realty.

4.2.4. Cumulative Impacts on Affected Resouces

Impacts associated with past, present, and reasonably foreseeable future actions are generally created by ground or vegetation-disturbing activities that effect natural and cultural resources in various ways. Of particular concern is the *accumulation* of these impacts over time. This section of the EA considers the nature of the cumulative effect and analyzes the degree to which the proposed action and alternatives contribute to the collective impact.

4.2.4.1. Air Quality

Relevant CIAA: General – hydrographic basin.

Impacts from Past and Present Actions: Past actions within the CIAA generally do not have an effect on air quality within the CIAA beyond a few days since winds are generally always moving air through the area and changing air quality conditions. At any given moment in time, active mining operations and actively burning fires would have a negative impact on air quality within the CIAA. Continual Naval Air Station Fallon overflights would add pollutants to the air within the CIAA.

Impacts from RFFAs: Continued mining and military overflights would continue to add pollutants to the air within the CIAA, as would wildland fires when they occur. Additional impacts to air quality could occur from expanding mining operations, in particular, the proposed expansion of the Coeur Rochester mine, which projects the release of pollutants in the following amounts:

- Mercury – 4-10 pounds per year
- Greenhouse gases – 4,000 metric tons per year
- PM10 – 28 pounds per hour
- PM2.5 – 9 pounds per hour
- Sulfur dioxide – 11 pounds per hour
- Oxides of nitrogen – 24 pounds per hour
- Carbon monoxide – 19 pounds per hour (Bureau of Land Management 2010c).

Cumulative Impacts:

Proposed Action

The contribution of the Proposed Action to cumulative greenhouse gas emissions would be negligible through implementation of the BMPs as described in section 2.1.11, Environmental Protection Measures and through compliance with NDEP BAPC air quality regulations. Cumulative contributions from the Proposed Project would be largely limited to the two-year drilling and construction phases of the project. During the operational phase of the project, the venting of hydrogen sulfide into the atmosphere would contribute to cumulative air quality impacts, but this effect is expected to decrease over the lifespan of the project as reservoir levels of such emissions decrease.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.2. Cultural Resources

Relevant CIAA: Cultural Resources.

Impacts from Past and Present Actions: Past and present actions on public and private lands have directly and indirectly affected the integrity of cultural resources determined eligible for the NRHP. Impacts on cultural resources in the CIAA have included recreation, wood and Christmas Tree cutting, fire, grazing, non-renewable minerals and fluid minerals exploration, and road building.

Impacts from RFFAs: All of the Past and Present Actions described above are expected to continue within the CIAA and are expected to continue to affect the integrity of cultural resources determined eligible for the NRHP.

Cumulative Impacts:

Proposed Action

Implementation of the Proposed Action could result in impacts to cairns and NRHP eligible archaeological sites due to increased access to previously remote areas. The presence of project components in the viewshed of some of the sites may alter their historical setting. However, if mitigation measures listed in Section 4.1.2 for Cultural Resources and 4.1.20 for Visual Resources are implemented, incremental impacts are anticipated to be minimal.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.3. Invasive, Non-Native Species

Relevant CIAA: Biological resources.

Impacts from Past and Present Actions:

Past and present actions from grazing, mining, ROWs, and fires have created surface disturbances. In general, these surface disturbances have facilitated the establishment and spread of invasive plant species in the region.

Impacts from RFFAs:

Impacts from past and present actions would likely continue under the reasonably foreseeable future actions. The Proposed Action would remove 268 acres of potentially occurring vegetation over the long term. It would also temporarily disturb an additional 245 acres of potentially occurring vegetation during construction. The long-term disturbance would combine with the 82 acres of long-term vegetation loss estimated for the access roads and well-pads associated with the original New York Canyon exploration project for a total cumulative long-term impact area of up to 595 acres. Further spread of invasive species could occur from surface disturbance caused by expanding mining and grazing operations. In addition, climate change may favor invasive plants, since they are generally more tolerant to a wider range of environmental conditions than are native plants (EPA 2011).

Cumulative Impacts:

Proposed Action

The Proposed Action would cumulatively contribute to habitat removal and degradation as described in Section 4.1.3, Invasive, Non-Native Species. Cumulative contributions from the Proposed Action would be largely limited to the two-year drilling and construction phases of the project. During the operational phase, vegetation would be permanently removed, but impacts from human disturbances would be reduced. In addition, reseeding of disturbed areas could re-establish habitat. Overall, the Proposed Action would have a negligible contribution to cumulative effects on invasive species within the analysis area.

Alternative 1

Cumulative impacts would be the same in nature as described under the Proposed Action but the project would contribute a slightly lower risk of invasive species introduction due to the shorter gen-tie line and smaller area of disturbance.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.4. Migratory Birds

Relevant CIAA: Biological resources.

Impacts from Past and Present Actions: Past and present actions have impacted migratory birds through the removal and degradation of habitat from grazing, mining, ROWs, and fires, and through noise and human disturbance associated with mining and Department of Defense activities.

Impacts from RFFAs: Impacts from past and present actions would likely continue under the reasonably foreseeable future actions. As stated in Section 4.1.19, Vegetation, the Proposed

Action would remove 268 acres of potential migratory bird habitat over the long term. It would also temporarily disturb an additional 245 acres of potential habitat during construction. The long-term disturbance would combine with the 82 acres of long-term habitat loss estimated for the access roads and well-pads associated with the original New York Canyon exploration project for a total cumulative long-term impact area of up to 595 acres. Additional impacts to migratory birds could occur from expanding grazing and mining operations. In addition, changes in climate are expected to cause geographic shifts in vegetation communities. This could cause the displacement of the migratory bird species that depend upon those habitats for survival.

Cumulative Impacts:

Proposed Action

The Proposed Action would cumulatively contribute to habitat removal, degradation, and migratory bird disturbance as described in Section 4.1.4, Migratory Birds. Cumulative contributions from the Proposed Action would be largely limited to the two-year drilling and construction phases of the project. During the operational phase, habitat would be permanently removed, but impacts from noise and human disturbances would be reduced. In addition, similar abundant habitat is found in the area and region, and reseeding of disturbed areas could re-establish migratory bird habitat. Overall, the Proposed Action would have a negligible contribution to cumulative effects on migratory bird species within the analysis area.

Alternative 1

Cumulative impacts would be the same in nature as described under the Proposed Action but the project would contribute a smaller amount to migratory bird habitat loss due to the shorter gen-tie line and smaller area of disturbance.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.5. Native American Religious Concerns

Relevant CIAA: General – hydrographic basin.

Impacts from Past and Present Actions: From contacts with settlers, disease and alcohol have decimated Northern Paiute and Western Shoshone population groups. Past historical actions in the CIAA, including mining and gravel extraction, grazing, home building, road construction, and recreation, have served to drive the Northern Paiutes off the land and confine them to reservations. Only in the past 50 years, through legislation, has an attempt been made by the federal and state governments to undo some of these actions.

Impacts from RFFAs: All of the Past and Present Actions described above are expected to continue within the CIAA and are expected to continue to affect the areas of Native American concern. In addition to these, the low level military flights as proposed by Travis Air Force Base would result in periodic, short bursts of loud noise over the traditional use areas. Some of the flights may occur over the use areas while Native Americans are present.

Cumulative Impacts:

Proposed Action

The Proposed Action is seen as causing both short-term (two year) and long-term adverse impacts to some of the NRHP listed TCPs. Implementation of the mitigation measures identified Section 4.1.5, Native American Religious Concerns would reduce these impacts. The proposed project would introduce short-term (up to two years) visual (construction equipment), audible (equipment and vehicle noise) and atmospheric (dust associated with construction) intrusions that are out of character with the TCPs and that would temporarily adversely affect the integrity of setting and feeling of the TCPs. Over the long-term, the project is expected to have a negligible visual intrusion for traditional uses within the Dave/Cornish Canyon, which has may have a view of project features in the southern polygon of the Geothermal Development Area. Project features may or may not be visible, but if they do turn out to be visible, they would be out of character with the TCPs. Since integrity, setting and feeling are part of the qualities that make this TCP eligible for listing on the NRHP, any visibility would constitute an adverse effect and an adverse impact. Mitigation has been included in this EA to minimize any such effects.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.6. Prime or Unique Farmlands

Relevant CIAA: General – hydrographic basin.

Impacts from Past and Present Actions: Past and present actions on public and private lands have directly and indirectly affected farmlands of statewide importance in the CIAA. Impacts to these lands have occurred from non-renewable minerals exploration and road building within the CIAA.

Impacts from RFFAs: The Past and Present Actions described above are expected to continue within the CIAA and are expected to continue to affect farmlands of statewide importance through soil removal and decreasing soil health through compaction and erosion. In addition to these actions, the proposed Iron Mine pipeline and transmission line would further affect farmlands of statewide importance.

Cumulative Impacts:

Proposed Action

The Proposed Action would construct a portion of the gen-tie line on farmland of statewide importance and would thereby contribute a cumulative impact.

Alternative 1

Cumulative impacts would the same in nature but greater in intensity than those described under the Proposed Action since Alternative 1 would construct a much longer portion of the gen-tie route on farmlands of statewide importance.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.7. Wastes, Hazardous or Solid

Relevant CIAA: General – hydrographic basin.

Impacts from Past and Present Actions: Mining and geothermal exploration have introduced and continue to introduce wastes into the CIAA, increasing the risk for spills and contamination of soils and groundwater.

Impacts from RFFAs: The Past and Present Actions above are expected to continue in addition to the New York Canyon Geothermal Exploration Project. These actions will continue to introduce wastes and associated risks of environmental contamination within the CIAA.

Cumulative Impacts:

Proposed Action

Solid waste and hazardous materials would be transported, stored, and used as part of the Proposed Action. All past, present and reasonably foreseeable future actions are required to transport, store, and use solid waste and hazardous materials in accordance with applicable state and federal regulations which are intended to protect the public and the environment. Implementation of the measures described in Section 4.1.7, Wastes, Hazardous or Solid, would minimize the potential for wastes and hazardous materials to be released to the environment from the Proposed Action. When combined with other current and reasonably foreseeable future area activities, the increase in the total volume of wastes handled would result in a small increased risk of spill or other release of waste materials to the environment.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.8. Water Quality (Surface/Ground)

Relevant CIAA: Buena Vista Valley Groundwater Basin 129.

Impacts from Past and Present Actions: Mining and geothermal exploration may have caused changes in water quality in quantity in areas of the CIAA where such activities have taken place, although all such activities are permitted and regulated by the BLM, the State of Nevada, or both, and all operations must adhere to permit conditions that reduce any such impacts.

Impacts from RFFAs: The potential for impacts from the past and present actions identified above would likely continue under the reasonably foreseeable future actions. Any such impacts would be minimized since all such activities are permitted and regulated by the BLM, the State of Nevada, or both, and all operations must adhere to permit conditions.

Cumulative Impacts:

Proposed Action

When combined with other current and potential future area activities, there would be an increased potential for impacts to groundwater quality. Potential impacts to groundwater temperature and quantity would be avoided or minimized through the use of BMPs for well construction and through implementation of the Water Monitoring Plan that has been developed for exploration and that would be amended for utilization. Drilling and well construction would be conducted in accordance with state and federal permit requirements. Percolation of geothermal fluids from well testing could have a temporary local impact on groundwater quality and water levels but would be minimized through the use of BMPs (i.e., bentonite clay lining of surface impoundments). Potential impacts to surface water would be temporary and local, and also would be avoided or minimized through the use of BMPs. Because potential impacts from the Proposed Action would be temporary, local, and monitored, any contribution to cumulative impacts would be minimal.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.9. Wetlands/Riparian Zones

Relevant CIAA: Buena Vista Valley Groundwater Basin 129.

Impacts from Past and Present Actions: Mining and geothermal exploration may have caused changes in water quality in quantity in areas of the CIAA where such activities have taken place, although all such activities are permitted and regulated by the BLM, the State of Nevada, or both, and all operations must adhere to permit conditions that reduce any such impacts.

Impacts from RFFAs: The potential for impacts from the past and present actions identified above would likely continue under the reasonably foreseeable future actions. Any such impacts would be minimized since all such activities are permitted and regulated by the BLM, the State of Nevada, or both, and all operations must adhere to permit conditions.

Cumulative Impacts:

Proposed Action

When combined with other current and potential future area activities, there would be an increased potential for impacts to groundwater quality. Potential impacts to groundwater temperature and quantity would be avoided or minimized through the use of BMPs for well construction and through implementation of the Water Monitoring Plan that has been developed for exploration and that would be amended for utilization. Drilling and well construction would be conducted in accordance with state and federal permit requirements. Percolation of geothermal fluids from well testing could have a temporary local impact on groundwater quality and water levels but would be minimized through the use of BMPs (i.e., bentonite clay lining of surface impoundments). Potential impacts to surface water would be temporary and local, and also would be avoided or minimized through the use of BMPs. Because potential impacts from the Proposed Action would be temporary, local, and monitored, any contribution to cumulative impacts would be minimal.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.10. Access and Transportation

Relevant CIAA: General – hydrographic basin.

Impacts from Past and Present Actions: No impacts to wetlands/riparian areas have been identified from other Past and Present Actions.

Impacts from RFFAs: No impacts from any identified RFFAs are expected.

Cumulative Impacts:

Proposed Action

The Proposed Action is not expected to result in any impacts to wetlands or riparian areas.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.11. Fire Management

Relevant CIAA: General – hydrographic basin.

Impacts from Past and Present Actions: Fire risk has been and is present within the CIAA from recreation, mining, and geothermal exploration activities.

Impacts from RFFAs: The Past and Present Actions above are expected to continue in addition to the New York Canyon Geothermal Exploration Project. These actions will continue to pose fire risk conditions within the CIAA.

Cumulative Impacts:

Proposed Action

The Proposed Action would pose a minor risk of sparking a fire from the use of heavy equipment. Because other current and reasonably foreseeable future actions carry a similar risk, the Proposed Action could contribute to the cumulative risk of fire started by human activity in the area.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.12. Land and Realty

Relevant CIAA: General – hydrographic basin.

Impacts from Past and Present Actions: Past and present actions have been consistent with BLM land use planning.

Impacts from RFFAs: RFFAs are expected to be consistent with BLM land use planning.

Cumulative Impacts:

Proposed Action

The Proposed Action is consistent with BLM land use planning for the area and would not interfere with other ongoing or reasonably foreseeable future activities, and therefore would not contribute to cumulative impacts on land use.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.13. Noise

Relevant CIAA: General – hydrographic basin.

Impacts from Past and Present Actions: Past actions within the CIAA add to noise levels in the CIAA. Due to the attenuation of noise over distance, generally only the portions of the CIAA within a few hundred to a few thousand feet of any of the identified actions have raised noise levels above the natural noise levels due to weather and wildlife.

Impacts from RFFAs: Continued mining and military overflights would continue to generate noise within the CIAA, as would some ranching activities when they occur. Additional noise impacts would occur from expanding mining operations, additional military overflights and geothermal exploration.

Cumulative Impacts:

Proposed Action

The contribution of the Proposed Action to cumulative noise effects would be negligible given the attenuation of noise over distance and the limited spatial and temporal extent of effect from any individual noise source.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.14. Paleontological Resources

Relevant CIAA: General – hydrographic basin.

Impacts from Past and Present Actions: Mining and geothermal exploration have been intrusive actions that have potentially impacted paleontological resources.

Impacts from RFFAs: The Past and Present Actions above are expected to continue to impact range resources into the future, as is the New York Canyon Geothermal Exploration Project.

Cumulative Impacts:

Proposed Action

Direct and indirect impacts of the Proposed Action on paleontological resources would be limited, because the majority of the Geothermal Development Area has a low likelihood of containing paleontological resources. Since other intrusive actions are currently taking place in the CIAA (mining, geothermal exploration), the Proposed Action could contribute to cumulative impacts on paleontological resources. However, because of the low paleontological sensitivity of area resources, and given the implementation of the Paleontological Monitoring Plan to protect any discovered resources, this incremental contribution would be minimal.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.15. Range Resources

Relevant CIAA: General – hydrographic basin.

Impacts from Past and Present Actions: Mining, fires and geothermal exploration activities have removed vegetation from lands within grazing allotments across the CIAA.

Impacts from RFFAs: The Past and Present Actions described above are expected to continue, along with the New York Canyon Geothermal Exploration project, which will remove a further 82 acres of vegetation from the Rochester Grazing Allotment.

Cumulative Impacts:

Proposed Action

Impacts on grazing would occur from loss of 245 acres of forage in the two-year short-term and the loss of 268 acres of forage in the long-term. Impacts would also occur due to the temporary

and permanent displacement of livestock within the Geothermal Development Area. When combined with other current and reasonably foreseeable future actions, the Proposed Action would contribute incrementally to cumulative impacts on range resources. The Proposed Action would not affect availability of water to livestock in the area, and the anticipated contribution of the Proposed Action to cumulative impacts would be minimal.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.16. Social and Economic Values

Relevant CIAA: General – hydrographic basin.

Impacts from Past and Present Actions: Mining and geothermal exploration have provided economic benefit to local communities and to county tax revenues.

Impacts from RFFAs: The Past and Present Actions above are expected to continue in addition to the New York Canyon Geothermal Exploration Project. These actions will continue to incrementally improve economic opportunities and conditions within the CIAA.

Cumulative Impacts:

Proposed Action

The Proposed Action would have a minor impact on the local economy from hiring local populations, where possible, and local spending on supplies during the construction and drilling process. This impact would contribute to a cumulative impact on the local economy when combined with similar spending and hiring from other current and reasonably foreseeable future actions.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.17. Soils

Relevant CIAA: General – hydrographic basin.

Impacts from Past and Present Actions: Soils have been and currently are impacted in the CIAA from fires, mining, recreation, grazing and geothermal exploration.

Impacts from RFFAs: The Past and Present Actions above are expected to continue in addition to the New York Canyon Geothermal Exploration Project. These actions will continue to impact soils within the CIAA.

Cumulative Impacts:

Proposed Action

Soil erosion could be caused by implementation of the Proposed Action as well as by other current actions. The contribution of the Proposed Action to cumulative impacts on soil erosion would be minimized through the use of the measures described in Section 4.1.17, Soils.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.18. Special Status Species

Relevant CIAA: Biological resources.

Impacts from Past and Present Actions: Past and present actions have impacted special status species through the removal and degradation of habitat from grazing, mining, ROWs, and fires, and through noise and human disturbance associated with mining and Department of Defense activities.

Impacts from RFFAs: Impacts from past and present actions would likely continue under the reasonably foreseeable future actions. As stated in Section 4.1.19, Vegetation the Proposed Action would permanent remove 268 acres of potential Species Status Species habitat. It would also temporary disturb an additional 245 acres of potential habitat during the construction of the Gen-tie lines. These disturbances would combine with the 82 acres of permanent vegetation disturbance estimated for the access roads and well-pads associated with the original New York Canyon exploration project for a total cumulative impact area of up to 595 acres. Additional impacts to special status species could occur from expanding grazing and mining operations. Furthermore, changes in climate could cause geographic shifts in vegetation communities, leading to the displacement of the species that depend upon those habitats for survival.

Cumulative Impacts:

Proposed Action

The Proposed Action would cumulatively contribute to habitat removal and degradation, as well as disturbances to special status species as described in Section 4.1.18, Special Status Species. Cumulative contributions from the Proposed Action would be largely due to noise and would be largely limited to the two-year drilling and construction phases of the project. Some habitat would be temporarily removed during this phase and then restored through revegetation, while some would be permanently removed to accommodate project features. During the operational phase, no new habitat removal would occur but noise disturbances would remain around the power plant area. Impacts on special status species would be more significant than impacts on common species because population viability is already uncertain for special status species, but impacts from noise and human disturbances would be reduced through Lease Stipulations, Applicant Proposed Environmental Protection Measures and Recommended Mitigation. In addition, similar abundant habitat is found in the area and region, and reseeding of temporarily disturbed areas

could re-establish habitat. Overall, the Proposed Action would have a negligible contribution to cumulative effects on special status species within the analysis area.

Alternative 1

Cumulative impacts would be the same in nature as described under the Proposed Action but the project would contribute fewer acres of impacts on potential special status species habitat due to the shorter gen-tie line and smaller area of disturbance.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.19. Vegetation

Relevant CIAA: Biological resources.

Impacts from Past and Present Actions:

Past and present actions have impacted vegetation through the removal of plant species and degradation of soil and vegetation caused by grazing, mining, ROWs, and fires.

Impacts from RFFAs:

Impacts from past and present actions would likely continue under the reasonably foreseeable future actions. The Proposed Action would remove 268 acres of potentially occurring vegetation over the long term. It would also temporarily disturb an additional 245 acres of potentially occurring vegetation during construction. The long-term disturbance would combine with the 82 acres of long-term vegetation loss estimated for the access roads and well-pads associated with the original New York Canyon exploration project for a total cumulative long-term impact area of up to 595 acres. Additional impacts to vegetation could occur from expanding mining, recreation and grazing operations. Furthermore, changes in climate could cause geographic shifts in vegetation communities into higher elevations and more northern latitudes. As these shifts occur, some habitats, such as grasslands, are expected to expand, while other habitats, such as alpine forests, are expected to contract or be displaced altogether. In addition, climate change is expected to reduce snowpack and rainfall throughout the Western US. This would increase the vegetation's susceptibility to wildfire (EPA 2011).

Cumulative Impacts:

Proposed Action

The Proposed Action would cumulatively contribute to vegetation removal and degradation as described in Section 4.1.19, Vegetation. Cumulative contributions from the Proposed Action would be largely limited to the two-year drilling and construction phases of the project. During the operational phase, habitat would be permanently removed, but impacts from human disturbances would be reduced. In addition, reseeding of disturbed areas could re-establish habitat. Overall, the Proposed Action would have a negligible contribution to cumulative effects on vegetation within the analysis area.

Alternative 1

Cumulative impacts would be the same in nature as described under the Proposed Action but the project would contribute fewer acres of vegetation impacts due to the shorter gen-tie line and smaller area of disturbance.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.20. Visual Resources

Relevant CIAA: General – hydrographic basin.

Impacts from Past and Present Actions: The visual quality of the CIAA has generally degraded over time from a generally remote and natural landscape to a landscape sprinkled with human developments such as roads, mines, and transmission lines. Mining, geothermal exploration and road constructions have been the primary contributors to these impacts.

Impacts from RFFAs: The Past and Present Actions above are expected to continue in addition to the New York Canyon Geothermal Exploration Project; however, that project is occurring in BLM Visual Resource Management Class IV lands, which allows alteration of the landscape.

Cumulative Impacts:

Proposed Action

Visual impacts from the Proposed Action would be long-term due to the introduction of a power plant and gen-tie lines into the landscape. Since the Proposed Action would occur in Class IV lands, only minimal impacts on visual resources would occur.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.21. Water Quantity

Relevant CIAA: Buena Vista Valley groundwater basin 129, as shown in Figure 23.

Impacts from Past and Present Actions: Mining, ranching, and geothermal exploration and production have all drawn upon groundwater within the CIAA.

Impacts from RFFAs: The Past and Present Actions above are expected to continue in addition to the New York Canyon Geothermal Exploration Project and the Iron Mine pipeline and transmission project. These actions will continue to consume groundwater in the CIAA.

Cumulative Impacts:

Proposed Action

The Proposed Action would add a new draw on groundwater within the CIAA of between 16,500 acre feet and 103,800 acre feet (depending on the technology selected) over the a 30-year project lifespan. Water would be obtained via existing or new water rights, which are managed by the State of Nevada per Nevada water law. The project is not expected to contribute impacts on other beneficial uses of water.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.22. Wild Horse Management

Relevant CIAA: General – hydrographic basin.

Impacts from Past and Present Actions: Mining and geothermal exploration have had impacts on wild horses through noise and visual disturbance, from removing vegetation that would otherwise be available for grazing, and by constructing physical barriers to wild horse movements. Fires have removed areas of vegetation from forage lands.

Impacts from RFFAs: The Past and Present Actions above are expected to continue in addition to the New York Canyon Geothermal Exploration Project. These actions will continue to incrementally reduce and impede wild horse movement.

Cumulative Impacts:

Proposed Action

Because human activity and noise resulting from the construction and drilling activities could temporarily displace wild horses from the area, and because the power plant and well field would remove vegetation and present physical barriers to movement, the Proposed Action could contribute incrementally to cumulative impacts on wild horses.

Alternative 1

Cumulative impacts would be the same as described under the Proposed Action.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.2.4.23. Wildlife

Relevant CIAA: Biological resources.

Impacts from Past and Present Actions: Past and present actions have impacted wildlife through the removal and degradation of habitat from grazing, mining, ROWs, and fires, and through noise and human disturbance associated with mining and Department of Defense activities.

Impacts from RFFAs: Impacts from past and present actions would likely continue under the reasonably foreseeable future actions. As stated in section 4.2.4.4, Vegetation, the Proposed Action would remove 268 acres of potential wildlife habitat over the long term. It would also temporarily disturb an additional 245 acres of potential habitat during construction. The long-term disturbance would combine with the 82 acres of long-term habitat loss estimated for the access roads and well-pads associated with the original New York Canyon exploration project for a total cumulative long-term impact area of up to 595 acres. Additional impacts on wildlife could occur from expanding grazing and mining operations. Furthermore, changes in climate may cause geographic shifts in vegetation communities. This could cause the displacement of the wildlife species that depend upon those habitats for survival.

Cumulative Impacts:

Proposed Action

The Proposed Action would cumulatively contribute to habitat removal, degradation, and wildlife disturbance as described in Section 4.1.23, Wildlife. Cumulative contributions from the Proposed Action would be largely limited to the two-year drilling and construction phases of the project. During the operational phase, habitat would be permanently removed, but impacts from noise and human disturbances would be reduced. In addition, similar abundant habitat is found in the area and region, and reseeding of disturbed areas could re-establish wildlife habitat. Overall, the Proposed Action would have a negligible contribution to cumulative effects on wildlife species within the analysis area.

Alternative 1

Cumulative impacts would be the same in nature as described under the Proposed Action but the project would contribute fewer acres of wildlife habitat impacts due to the shorter gen-tie line and smaller area of disturbance.

No Action Alternative

The No Action alternative would make no contribution to cumulative impacts.

4.3. Recommended Mitigation

This section provides a list of all BLM-recommended mitigation that will be applied to this project. These mitigations are in addition to Lease Stipulations and the Applicant-Proposed Environmental Protection Measures listed in Section 2.1.11.

4.3.1. Cultural Resources

- TGP shall install fencing at a 30-foot radius around all cairns identified by the BLM. TGP shall coordinate with the BLM range specialist to determine the appropriate type of fencing.
- TGP shall provide training to all onsite employees on the importance of protecting cultural resources and the consequences of any violations. This training shall be presented every two years to continuing employees.
- Signage shall be implemented to indicate that access roads through the plant area and well pads are “no through traffic.”

- The traditional roads identified as CrNV-02-9535 and CrNV-02-9577 shall not be utilized by TGP for drilling, plant construction and/or access to the plant.

- TGP shall provide a 50 meter avoidance buffer on each of the traditional roads identified as CrNV-02-9535 and CrNV-02-9577. All disturbance and development shall be at least 50 meters (164 feet) away from these traditional routes.

- No construction, drilling or geothermal production shall occur within a ¼ mile of a boundary of a known NRHP eligible TCP.

- Since the proponent has agreed to avoid all NRHP eligible archaeological sites, no access roads would be permitted through NRHP eligible archaeological sites. Should access roads have to pass through contributing elements of any NRHP eligible archaeological site, a data recovery/mitigation plan should be developed before construction. This is to insure compliance with Section 106 of the National Historic Preservation Act.

4.3.2. Invasive, Non-native Species

- TGP shall revise the Invasive Plant Management Plan in place for the exploration phase to include all portions of the Project Area, including the Geothermal Development Area and the selected gen-tie route, and to address ongoing operations and maintenance activities. This plan would be submitted to the BLM and would need to receive BLM approval prior to issuance of any Notice to Proceed and/or right-of-way grant. The plan should include, at a minimum, a proposed inventory schedule, including season of inventory, reporting schedule, methods of treatment and success criteria. Methods of treatment shall follow standard BLM Standard Operating Procedures and Best Management Practices.

4.3.3. Migratory Birds

- All preconstruction surveys shall follow standard Winnemucca District protocol. Where a protocol does not exist, proposed survey protocols must be approved by Winnemucca District prior to implementation.

4.3.4. Native American Religious Concerns

- TGP would not block access for the Native Americans to CrNV-02-9535 and CrNV-02-9577, nor put any impediments along these two routes which would prohibit travel along these routes by the Native Americans. Allow Native Americans access to TCPs and sacred sites. TGP would not block access to the road running along the ridge of the Stillwater Range.

- TGP would not conduct any off-road or cross-country travel. All vehicular travel must be on roads built and maintained by TGP.

- Well pads including sump perimeters in the southern leases (N-86890, N-76300, and N-76299) would be successfully re-vegetated within six months after drilling and flow testing. Re-seeding would be done using weed free and BLM approved seed mixtures. If used for production, the remaining unvegetated area must be less than 15 feet x 15 feet and the rest of the pad revegetated.

- All non-emergency construction, drilling and maintenance would be prohibited in the southern leases (N-86890, N-76300, and N-76299) during September and October. If the pine-nut season extends into November, the above-listed activities would be prohibited during that month. Each year, through consultation with the tribes and TCP users, the BLM would determine if the pine nut season extends into November.

- All exploratory drilling would be done within 3 years.

- To reduce visual impacts to the settings of the TCPs, unless used for production, all well pads outside of the leases mentioned in #3 will be reclaimed and revegetated within 6 months of exploratory/production drilling. For the wells used in production, the remaining unvegetated area must be less than 15 feet x 15 feet and the rest of the pad revegetated.

- No pinyon trees marked as "Seed Trees" will be cut down for any of the construction.

4.3.5. Water Quality (Surface/Ground)

- Water would be monitored per a BLM-approved water monitoring plan developed for the development and utilization phase of the project. The plan would be adapted from the water monitoring plan developed for exploration and may include various springs, surface water sources and groundwater sources. Production and utilization activities would not begin until the BLM has approved the adapted (for production and utilization) monitoring plan. To provide an understanding of baseline conditions, at least four quarters of monitoring as directed by the exploration phase monitoring plan must have been completed and implementation of the adapted (for production and utilization) plan must be initiated prior to any production or utilization drilling.

- TGP would not utilize any water from the stock pond, nor the seasonal creeks in any of their operations. TGP would avoid doing any modifications to the stock pond that would destroy its integrity.

- Reserve pit waste shall be sampled for hazardous contaminants. Typical tests may include the Toxicity Characteristic Leaching Procedure (TCLP) (EPA Method 1311), tested for heavy metals; pH (EPA Method 9045D); Total Petroleum Hydrocarbons/Diesel (EPA Method 8015B); and Oil and Grease (EPA Method 413.1). Contaminated materials, if any, shall be disposed of at an approved facility.

4.3.6. Paleontological Resources

- Applicant must follow the Paleontological Monitoring Plan that has been prepared for this project, including arranging for, in coordination with the BLM, an intensive survey of all areas underlain by geologic units determined by the BLM to have a PFYC Class 4 or higher.

4.3.7. Range Resources

See mitigation for Wildlife.

4.3.8. Special Status Species

- During development and production phases, artificial ponds will be fitted with floating balls. (To prevent birds and bats from becoming entrained in netting, netting shall not be used.) Floating balls shall be installed in numbers that cover maximum fluid surface area at maximum allowable freeboard.

- TGP shall avoid any construction activities within 200 yards of bat hibernation locations during bat hibernation season of September 15th to April 30th.

4.3.9. Vegetation

- Any graveled areas not identified for development within two years shall be topsoiled and seeded as described in Section 2.1.1.12 Restoration and Reclamation.

4.3.10. Visual Resources

- Construction of all facilities would utilize screening on proposed stationary lights and light plants. Lighting would be directed onto the pertinent site only and away from adjacent areas not in use with safety and proper lighting of the active work areas being the primary goal. Lighting fixtures would be hooded and shielded as appropriate.

4.3.11. Wildlife

- TGP shall place escape ramps every 200 linear feet around the perimeter of the sump, that are covered with geo-mesh, that are sloped 3:1 (horizontal:vertical) or flatter and that are at least 8 feet wide each.

- Fencing shall be installed 6-feet from the edges of the berms. Fences shall be 4-strand or chain-link of at least 4 feet high with the bottom 2 feet made of a mesh with holes no greater than two inches.

Figure 18. Construction Noise from Proposed Action Gen-Tie and Tie Line Options

Figure 19. Power Plant Construction and Operation Noise Contours for Golden Eagle Impact Analysis

Figure 20. Construction Noise from Alternative 1 Gen-Tie and Tie Line Options

Figure 21. Power Plant Construction and Operation Noise Contours for Native American Impact Analysis

Figure 22. Biological Resources CIAA

Figure 23. General CIAA

Chapter 5. Tribes, Individuals, Organizations, or Agencies Consulted:

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5.1. Consultation and Coordination

Consultation was conducted with local Native American tribes to help assess impacts on Native American Traditional Cultural Properties. These interactions are detailed below in Table 5.1.

Table 5.1. List of Tribal Outreach, Contact, and Consultation

Date	Type	Parties
April 14-25, 2011	Consultation letters	BLM sent to Fallon Paiute-Shoshone Tribe, Lovelock Paiute Tribe and interested tribal members
June 15, 2011	Consultation meeting	BLM presented information on project to Fallon Paiute-Shoshone Tribe
July 20, 2011	Informational meeting	BLM presented information on project to Fallon Paiute-Shoshone Tribe
March 12, 2012	Follow-up consultation letters	BLM sent to Fallon Paiute-Shoshone Tribe, Lovelock Paiute Tribe and interested tribal members
July 5, 2012	Phone calls to tribal headquarters arrange consultation meetings (messages left)	BLM called Fallon Paiute-Shoshone Tribe and Lovelock Paiute Tribe
September 19, 2012	Consultation meeting	BLM with Lovelock Paiute Tribe
October 10, 2012	Consultation meeting	BLM with Lovelock Paiute Tribe and interested tribal members
March 15, 2013	Consultation meeting	BLM with Fallon Paiute-Shoshone Tribe and the Lovelock Paiute Tribe
May 15, 2013	Phone call	BLM call to the Lovelock Paiute Tribe to inquire if they wanted to arrange a consultation meeting. Message left with the chairman; no response.
May 17, 2013	Consultation meeting	BLM and tribal representatives of the Fallon Paiute-Shoshone Tribe.

Table 5.2 outlines consultations with additional agencies and individuals.

The Nevada Department of Wildlife was involved in project meetings from the pre-application phase onward. Scoping letters were sent out to the County, to State of Nevada regulatory agencies, and to area landowners and land users.

TGP has submitted a draft Bird and Bat Conservation Strategy/Eagle Conservation Plan to the USFWS. Measures from that draft have been utilized in the development of this EA.

BLM sent a letter to the Advisory Council on Historic Preservation on November 13, 2012 requesting their involvement as a consulting party; through email correspondence, they declined.

Table 5.2. List of Persons, Agencies and Organizations Consulted

Name	Purpose & Authorities for Consultation or Coordination	Findings & Conclusions
Kenny Pirkle, Nevada Department of Wildlife	To solicit input on wildlife issues in the Project Area.	Identification of wildlife issues that were then addressed in biological survey report and EA
Donna Cossette, Fallon Paiute Shoshone Tribe, interested party	Continuation of ongoing consultation from exploration EA. Section 106 Government-to-Government Consultation.	Consultation is ongoing.
Rebecca Palmer, Deputy Director, State Historic Preservation Office	To receive concurrence or other feedback on Class III Cultural Resources Surveys. National Historic Preservation Act.	Concurrence with reports as submitted. Consultation meeting on May 8, 2013; SHPO agreed proposed action and alternative was below threshold.
US Fish and Wildlife Service	To solicit a list of any threatened or endangered species in the Project Area. To coordinate on the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.	No threatened or endangered species are listed in the Project Area. Golden eagles are present and a Bird and Bat Conservation Strategy/Eagle Conservation Plan is currently a draft document that will be finalized with US Fish and Wildlife Service prior to implementation of the project.
Nevada Natural Heritage Program	To acquire a list of NNHP special status species that may occur in the Project Area.	List received, which helped to focus the rare plant surveys.
American Council on Historic Preservation	Consultation per Section 106 of the National Historic Preservation Act.	Council declined to become a consulting party for the project.

5.2. Public Involvement/Outreach

Scoping activities conducted in support of this project included sending out a Dear Interested Party Letter with an attached project overview map. These materials were sent to the project mailing list for a 30–day public scoping period ending February 10, 2012. Refer to Section 1.3 for a summary of the results of scoping activities. Letters were sent to the Native American tribes listed in Section 5.1.

A Preliminary Environmental Assessment was released for public review from April 22, 2013 through May 22, 2013. The BLM issued a press release on the BLM Winnemucca District website, and sent Interested Party letters to the project mailing list and letters were also sent to the Native American tribes listed in Section 5.1.

Chapter 6. List of Preparers

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[Enter the Preparers List here.]

Table 6.1. List of Preparers

Name	Title	Responsible for the Following Section(s) of this Document
Phil D'Amo	Geologist	Project Manager, Minerals, Groundwater
Lynn Ricci	Planning and Environmental Coordinator	NEPA Compliance
Joey Carmosino	Outdoor Recreation Planner	Visual Resources
John McCann	Hydrologist	Surface Water Resources, Wetlands/Riparian
Melanie Mirati	Wild Horse and Burro Specialist	Wild Horse and Burro
Celeste Mimnaugh, Sandra Brewer	Biologist	Wildlife, Special Status Species, Migratory Birds, Noise
Debbie Dunham	Realty Specialist	Lands and Realty
Mark Hall	Archaeologist/ Native American Coordinator	Cultural Resources, Native American Religious Concerns, Paleontology, Noise
Damon Corley	Rangeland Specialist	Rangeland Management
Derek Messmer	Fire Management Specialist	Fire Management, Fuels, Fire Rehab
Rob Burton	Natural Resource Specialist	Vegetation, Soils
Craig Nicholls	Physical Scientist	Air Quality
Kristine Struck	Wilderness Specialist	Lands with Wilderness Characteristics
Josh Sidon	Economist	Social Values, Economics, Environmental Justice
Robert Bunkall	GIS Specialist	GIS
Mark Turney	Public Affairs Officer	Public Outreach
John Callan	Environmental Protection Specialist	Hazardous and Solid Wastes
Eric Baxter	Natural Resource Specialist	Invasive Species

Table 6.2. Cooperating Agencies

Name	Agency
Karen Wesner	Pershing County
Kenny Pirkle	Nevada Division of Wildlife

Table 6.3. 3rd Party NEPA Consultant ID Team

Name	Title	Specialty/Responsibility	Years of Experience
EMPSi			
Andrew Gentile	Project Manager	Lands and Realty, Range Resources, Paleontological Resources, Visual Resources, Wild Horse Management, Fire Management, Soils, Wastes, Recreation, Noise, Access and Transportation	11
Amy Cordle	Engineer	Air Quality	18
Annie Daly	Environmental Specialist	Air Quality	1.5
Jordan Tucker	Environmental Specialist	Lands and Realty	3.5

Lauren Zielinski	Environmental Specialist	Economic Values	3
Jennifer Thies	Senior Environmental Planner	Economic Values	14
Meredith Zaccherio	Senior Biologist	Wildlife, Vegetation, Special Status Species, Migratory Birds, Invasive, Non-Native Species	7
Matt Kluvo	Environmental Specialist	Wildlife, Vegetation, Special Status Species, Migratory Birds, Invasive, Non-Native Species	4.5
Marcia Rickey	GIS Specialist	Various calculations and maps	12
Jenna Jonker	GIS Specialist	Various calculations and maps	3
Laura Long	Editor	Full EA	6
AMEC			
Doug Rogness	Hydrogeologist	Water Quantity and Quality	30

Chapter 7. References

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