BLM

Stillwater Field Office, Nevada

ENVIRONMENTAL ASSESSMENT

TGP Dixie Development Company, LLC

Coyote Canyon South Geothermal Exploration

DOI-BLM-NV-C010-2012-0051-EA

U.S. Department of the Interior
Bureau of Land Management
Carson City District
Stillwater Field Office
5665 Morgan Mill Road
Carson City, NV 89701
775-885-6000

September, 2012

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

DOI-BLM-NV-C010-2012-0051-EA

Table of Contents

Page

1.0 INTRODUCTION/PURPOSE AND NEED 1
1.1 LEASE AREAS AND RIGHTS-OF-WAY 1
1.2 PURPOSE AND NEED 2
1.2.1 PURPOSE 2
1.2.2 NEED 3
1.3 DECISION TO BE MADE 3
1.4 LAND USE PLAN CONFORMANCE STATEMENT 3
1.5 RELATIONSHIP TO STATUTES, REGULATIONS AND OTHER PLANS 3
2.0 PROPOSED ACTIONS AND ALTERNATIVES 8
2.1 PROPOSED ACTION 8
2.1.1 OVERVIEW AND LOCATION OF PROPOSED ACTION 8
2.1.2 SCHEDULE OF EXPLORATION ACTIVITIES 9
2.1.3 SITE ACCESS AND ROAD IMPROVEMENTS 10
2.1.4 LAND OWNERSHIP AND RIGHTS-OF-WAY 11
2.1.5 SITE PREPARATION ACTIVITIES 11
2.1.6 AGGREGATE SUPPLY FOR ROAD AND PAD CONSTRUCTION 13
2.1.7 WATER SUPPLY FOR GRADING, DRILLING AND DUST ABATEMENT 14
2.1.8 WELL PAD AND DRILLING OPERATIONS 15
2.1.9 PLANS FOR SURFACE RECLAMATION 18
2.1.10 STANDARD OPERATING PROCEDURES, BEST MANAGEMENT PRACTICES, AND PROPOSED MITIGATION 20
2.2 NO ACTION ALTERNATIVE 22
3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES ..27
3.1 SCOPING AND ISSUE IDENTIFICATION 27
3.1.1 PROPOSED ACTION GENERAL SETTING 27
3.1.2 SUPPLEMENTAL AUTHORITIES 27
3.1.3 RESOURCES OTHER THAN SUPPLEMENTAL AUTHORITIES 29
3.1.4 RESOURCES OR USES PRESENT AND BROUGHT FORWARD FOR ANALYSIS (ALL SUPPLEMENTAL AND RESOURCES) 30
3.2 AIR QUALITY 30
3.2.1 REGULATORY ENVIRONMENT 30
3.2.2 AFFECTED ENVIRONMENT 30
3.2.3 ENVIRONMENTAL CONSEQUENCES 31
3.3 FLOODPLAINS 32
3.3.1 REGULATORY ENVIRONMENT 32
3.3.2 AFFECTED ENVIRONMENT 33
3.3.1 ENVIRONMENTAL CONSEQUENCES 33
3.4 WATER RESOURCES 33
3.4.1 AFFECTED ENVIRONMENT 33
3.4.2 ENVIRONMENTAL CONSEQUENCES 35
3.5 SOILS 36
3.5.1 AFFECTED ENVIRONMENT 36

3.5.2 ENVIRONMENTAL CONSEQUENCES 37
3.6 VISUAL RESOURCES 38
3.6.1 AFFECTED ENVIRONMENT 38
3.6.2 ENVIRONMENTAL CONSEQUENCES 39
3.7 LANDS AND REALTY 39
3.7.1 AFFECTED ENVIRONMENT 39
3.7.2 ENVIRONMENTAL CONSEQUENCES 40
3.8 MINERALS 41
3.8.1 AFFECTED ENVIRONMENT 41
3.8.2 ENVIRONMENTAL CONSEQUENCES 41
3.9 VEGETATION 41
3.9.1 AFFECTED ENVIRONMENT 41
3.9.2 ENVIRONMENTAL CONSEQUENCES 43
3.10 INVASIVE, NONNATIVE, AND NOXIOUS WEED SPECIES 43
3.10.1 REGULATORY ENVIRONMENT 43
3.10.2 AFFECTED ENVIRONMENT 43
3.10.3 ENVIRONMENTAL CONSEQUENCES 44
3.11 MIGRATORY BIRDS 44
3.11.1 REGULATORY ENVIRONMENT 44
3.11.2 AFFECTED ENVIRONMENT 45
3.11.3 ENVIRONMENTAL CONSEQUENCES 47
3.12 WETLANDS/RIPARIAN ZONES 47
3.12.1 REGULATORY ENVIRONMENT 47
3.12.2 AFFECTED ENVIRONMENT 48
3.12.3 ENVIRONMENTAL CONSEQUENCES 48
3.13 WILDLIFE/KEY HABITAT 48
3.13.1 AFFECTED ENVIRONMENT 48
3.13.2 ENVIRONMENTAL CONSEQUENCES 49
3.14 SPECIAL STATUS SPECIES 49
3.14.1 REGULATORY ENVIRONMENT 49
3.14.2 AFFECTED ENVIRONMENT 51
3.14.3 ENVIRONMENTAL CONSEQUENCES 55
3.15 CULTURAL RESOURCES 56
3.15.1 AFFECTED ENVIRONMENT 56
3.15.2 ENVIRONMENTAL CONSEQUENCES 57
3.16 NATIVE AMERICAN RELIGIOUS CONCERNS 58
3.16.1 AFFECTED ENVIRONMENT 58
3.16.2 ENVIRONMENTAL CONSEQUENCES 58
3.17 NO ACTION ALTERNATIVE 58
3.18 RESIDUAL IMPACTS 59
4.0 CUMULATIVE EFFECTS 63
4.1 PAST AND PRESENT ACTIONS 63
4.2 REASONABLY FORESEEABLE FUTURE ACTIONS 63
4.3 CUMULATIVE IMPACTS 63
4.3.1 AIR QUALITY 63
4.3.2 WATER QUALITY 64

4.3.3 VISUAL RESOURCES 64
4.3.4 BIOLOGICAL RESOURCES.....64
4.3.5 CULTURAL RESOURCES.....64
4.3.6 NATIVE AMERICAN CONCERNS.....65
4.3.7 NO ACTION ALTERNATIVE 65
5.0 CONSULTATION AND COORDINATION.....66
5.1 AGENCIES, GROUPS, AND INDIVIDUALS CONTACTED 66
5.2 LIST OF PREPARERS.....66
6.0 REFERENCES.....68

List of Tables

Table 1: Coyote Canyon South Geothermal Leases/Unit 2
Table 2: Potential Regulatory Permits and Approvals for the TGP Dixie Development Company, LLC Coyote Canyon South Geothermal Exploration Project.....5
Table 3: Exploration Well Pad Locations 9
Table 4: Summary of Disturbed Acreage 11
Table 5: Summary of Aggregate Requirements.....13
Table 6: Supplemental Authorities and Rationale for Detailed Analysis for the Proposed Action 28
Table 7: Resources Other Than Supplemental Authorities.....29
Table 8: SWReGAP Landcover Types within the Project Area.....42
Table 9: Birds of Conservation Concern Potentially Occurring within the Project Area.....45
Table 10: Typical Wildlife Species Associated with Habitats within Project Area 48
Table 11: BLM Sensitive Species Potentially Occurring within the Project Area 51
Table 13: List of Preparers.....67

List of Figures

Figure 1. Project Location and Gravel Sources 6
Figure 2. Proposed Action and Lease Area 7
Figure 3. Typical Well Pad Layout.....23
Figure 4. Gravel Pit Location T24N R36E S1.....24
Figure 5. Gravel Pit Location T24N R36E S16.....25
Figure 6. Gravel Pit Location T24N R37E S11.....26
Figure 7. Groundwater Basin.....60
Figure 8. Water Features.....61
Figure 9. Soils 62

List of Appendices

Appendix A: Geothermal Leases and Stipulations
Appendix B: Inter-Disciplinary Team Checklist for EA Preparation
Appendix C: Biological Survey Report

LIST OF ACRONYMS AND ABBREVIATIONS

BLM	United States Department of the Interior, Bureau of Land Management
BMP	best management practice
CCS	Coyote Canyon South
CFR	Code of Federal Regulations
DOI	United States Department of the Interior
EA	environmental assessment
NEPA	National Environmental Policy Act of 1969
PEIS	programmatic environmental impact statement
RMP	resource management plan
ROW	right-of-way
SFO	Stillwater Field Office
SWReGAP	Southwest Regional GAP Analysis Project
TGP	TGP Dixie Development Company
US	United States
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VRM	visual resource management

1.0 INTRODUCTION/PURPOSE AND NEED

This Environmental Assessment (EA) analyzes the potential impacts associated with the proposed construction and testing of geothermal exploration wells, access roads, and ancillary facilities in Dixie Valley, as well as the expansion of and extraction of materials from two aggregate pits in Churchill County, Nevada (**Figure 1**, Project Location and Gravel Sources). Terra-Gen Power Dixie Development Company (TGP) proposes to expand a previously approved geothermal exploration area, originally called "Coyote Canyon". This new proposal is to explore the geothermal resource potential of lands directly to the south of Coyote Canyon in three additional federal geothermal leases, referred to here as the Coyote Canyon South (CCS) lease area (Lease Area). The Lease Area is on federal lands managed by the United States (US) Department of the Interior, Bureau of Land Management (BLM) in Dixie Valley. The BLM is the lead agency for this EA in accordance with the National Environmental Policy Act (NEPA) (40 Code of Federal Regulations [CFR] Parts 1500-1508).

The purpose of the geothermal exploration is to confirm that sufficient reservoir capacity is available to allow long-term production. This EA analyzes potential impacts from the proposed exploration and testing activities.

The exploration activities and associated gravel pit expansions and extraction are referred to as the Propoed Action. The geothermal leases held by TGP for the CCS exploration project contain 7,588 acres, which comprise the Lease Area.

TGP proposes to conduct geothermal exploration in a portion of the Lease Area called the Project Area. **Figure 2**, Proposed Action and Lease Area. shows the Lease Area and Project Area.

An operations plan to drill and test up to 15 explorations wells at the Project Area was submitted to the BLM, Stillwater Field Office (SFO) in August 2011. Revised Operations Plans were submitted in October 2011 and again in December 2011.

In addition to the exploration drilling program, mineral material sales contracts would be required for aggregate material obtained from three BLM-managed gravel pits. Gravel extraction from one of the pits was analyzed under a previous NEPA document, and so this EA addresses impacts associated with the other two pits.

Individual geothermal drilling permits would be issued separately from this document.

1.1 LEASE AREAS AND RIGHTS-OF-WAY

Leases held by TGP for the Proposed Action are shown in Figure 2, Proposed Action and Lease Area.

The original lease area at Coyote Canyon that was analyzed for the previously approved exploration and utilization activities covered 7,637 acres. These lands are located directly to the north of the proposed CCS project area (Project Area). The Project Area is defined by the area that has been surveyed under a Class III cultural resources survey in support of the CCS project.

The Project Area covers 3,530 acres within the CCS Lease Area and up to an additional 45 acres for gravel extraction distributed across three gravel pits. The Lease Area is composed of the following three leases purchased by TGP:

- N-86889, which covers 5,045 acres;
- N-88416, which covers 1,263 acres; and
- N-89605, which covers 1,280 acres.

In total, the Lease Area covers 7,588 acres. When combined, the current Lease Area and the original Coyote Canyon lease area to the north cover 15,225 acres. In 2011, the BLM approved the new Coyote Canyon Unit, which includes all 15,225 acres, including all 7,588 acres of the Lease Area and, subsequently, all 3,530 acres of the Project Area (the 45 acres of gravel pits are outside of the Lease Area). The Project Area is shown within the context of the Coyote Canyon Unit and the original Coyote Canyon project area on Figure 2, Proposed Action and Lease Area. Leases held by TGP in the Lease Area, and their effective dates are shown in **Table 1**, Coyote Canyon South Geothermal Leases/Unit.

The primary access to the Lease Area would be via US Route 50 from Fallon. From Route 50, Highway 121 leads north, through Dixie Valley, to the Lease Area.

On October 23, 2009, as part of the original Coyote Canyon project, TGP submitted applications for rights-of-way (ROWs) to develop roads between TGP's separate geothermal leases. This off lease action would provide connectivity to the Lease Area from the original Coyote Canyon lease area. No new ROWs are required for on-lease access roads.

Table 1: Coyote Canyon South Geothermal Leases/Unit

Lease Serial Number	Section Number	Township, Range	Lease Effective Date
N-86889	Sections 19-20 and 28-32	T24N, R36E	September 2009
N-88416	Sections 5-6	T23N, R36E	July 2010
N-89605	Sections 27 and 33	T24N, R36E	May 2011

1.2 PURPOSE AND NEED

1.2.1 Purpose

The purpose of the Proposed Action is to explore the geothermal energy production potential of federal lands managed by the BLM and leased by TGP. This EA has been prepared by the BLM in accordance with NEPA to assess the potential for environmental impacts resulting from installation and testing of exploration wells, which comprise the Proposed Action. This EA serves to support the BLM in determining whether the Proposed Action, with or without any modifications required by the BLM, would result in significant environmental impacts. Based on this determination, a Finding of No Significant Impact could be made. Alternatively, if significant impacts have the potential to occur, the BLM could determine that an environmental impact statement is required.

1.2.2 Need

In accordance with the BLM Programmatic Environmental Impact Statement (PEIS) for Geothermal Development (BLM 2008a) and the Churchill County Master Plan (2010), the expansion and development of geothermal resources is supported and promoted for federal lands in this region in support of the need "to ensure jobs for our future with secure, affordable, and reliable energy" as identified in the Energy Policy Act of 2005. Additionally, the need for the proposed action is to respond to Executive Order 13212, which directs the BLM to process geothermal leases in a timely manner in order to support efforts to increase energy production from federal minerals while preserving the health of public lands.

1.3 DECISION TO BE MADE

Applications for geothermal drilling upon public land submitted to BLM may be approved only after an environmental analysis is completed. BLM decision options include approving the Proposed Action as defined in the plan of operations as submitted by TGP; approving the Proposed Action with conditions of approval to mitigate environmental impacts; or denying the Proposed Action.

1.4 LAND USE PLAN CONFORMANCE STATEMENT

The Proposed Action and alternatives described below are in conformance with the Carson City District Office Consolidated Resources Management Plan (RMP) (BLM 2001),

1.5 RELATIONSHIP TO STATUTES, REGULATIONS AND OTHER PLANS

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

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

- NEPA of 1969, as amended (Public Law 91-190, 42 US Code [USC] 4321 [et seq.])
- 40 CFR 1500 (et seq.), Regulations for Implementing the Procedural Provisions of NEPA
- Considering Cumulative Effects under NEPA (CEQ 1997)
- 43 CFR Part 46, Implementation of NEPA of 1969; Final Rule, effective November 14, 2008
- Department of the Interior requirements (Departmental Manual 516, Environmental Quality [DOI 2008])
- BLM NEPA Handbook (H-1790 1), as updated (BLM 2008b)
- The Geothermal Steam Act of 1970 (30 USC 1001-1025)
- 43 CFR 3200, Geothermal Resources Leasing and Operations; Final Rule, May 2, 2007
- The 2005 Energy Policy Act; The National Energy Policy, Executive Order 13212, and BMPs as defined in *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, Fourth Edition* (Gold Book) (BLM 2007)

- The Geothermal Energy Research, Development, Demonstration Act of 1974
- Federal Land Policy and Management Act of 1976, as amended, Section 501 (43 USC 1961)
- The Federal Land Policy and Management Act of 1976 (PL 94 579, 43 USC 1761 [et seq.])
- Rights-of-Way under the Federal Land Policy and Management Act and the Mineral Leasing Act (43 CFR 2880), final Rule, April 22, 2005
- Churchill County Master Plan (2010 Update) (Churchill County Planning Department 2010)
- Carson City District NEPA Compliance Guidebook (Draft) (BLM 2008c)
- Mineral Material Disposals (43 CFR 3601)
- The Act of July 31, 1947, as amended (30 USC 601 [et seq.])
- The US Government is authorized to collect fees and to require reimbursement of its costs, as described in Section 304 of Federal Land Policy and Management Act [43 USC 1734] and the Independent Offices Appropriation Act of 1952 [31 USC 9701]
- Rights-of-Way, Principles and Procedures; Rights-of-Ways under the Federal Land Policy and Management Act and the Mineral Leasing Act; final Rule April 22, 2005. (43 CFR 2800)

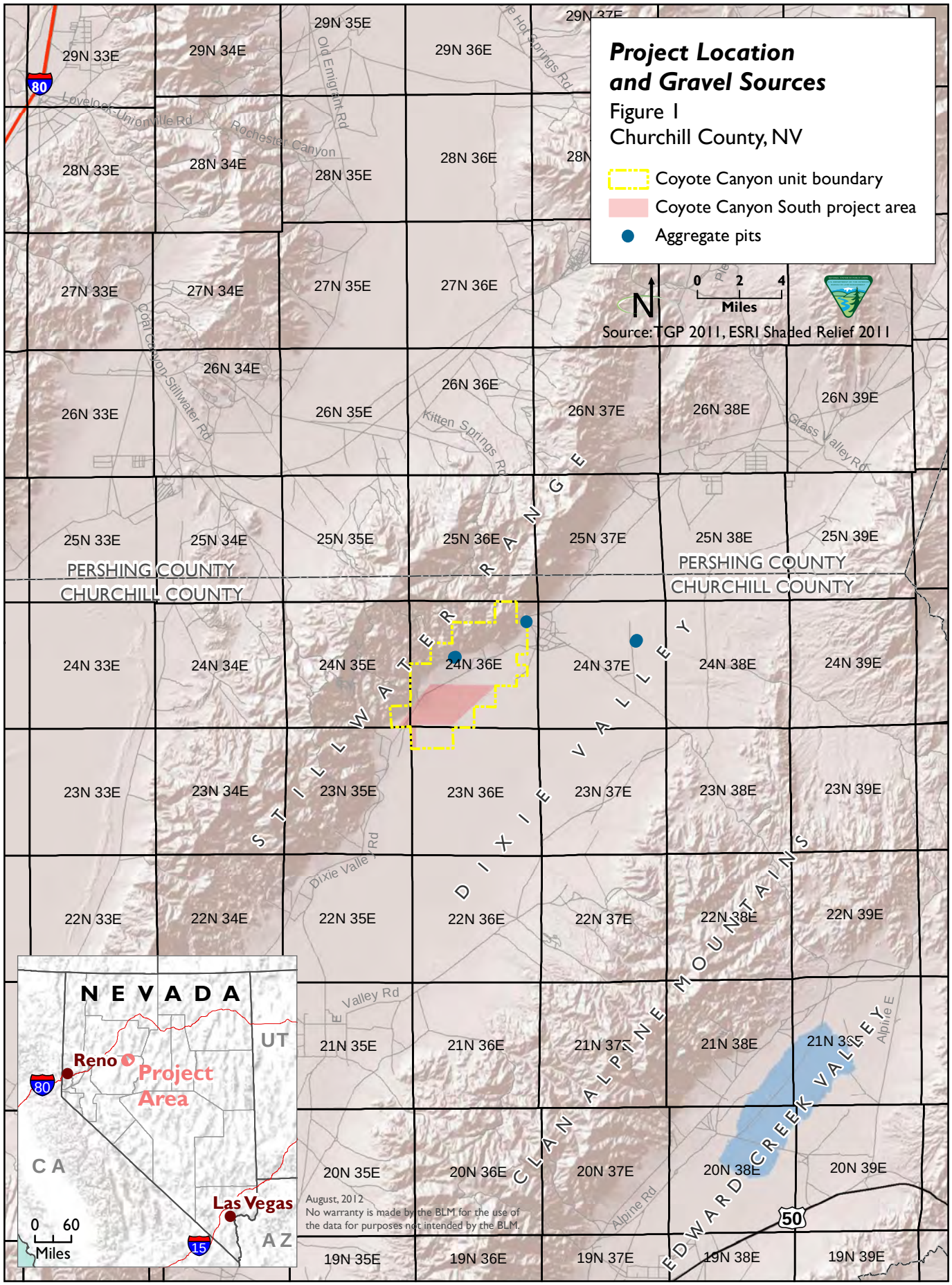
In 2008, the BLM completed the PEIS for Geothermal Resources Leasing in the Western United States (BLM 2008a). This PEIS was the foundation for a Record of Decision and RMP Amendments for Geothermal Resources Leasing in the Western United States, (BLM 2008d). This Record of Decision amended BLM RMPs, including the Carson City Consolidated RMP (2001), to identify public lands that are administratively and legally closed or open to leasing and to develop a comprehensive list of stipulations, BMPs, and procedures to serve as consistent guidance for future geothermal leasing and development. Special stipulations developed in the Record of Decision were applied to geothermal resource leases subsequently issued by BLM, including each of the three federal geothermal leases issued to TGP for Coyote Canyon in 2009, 2010, and 2011.

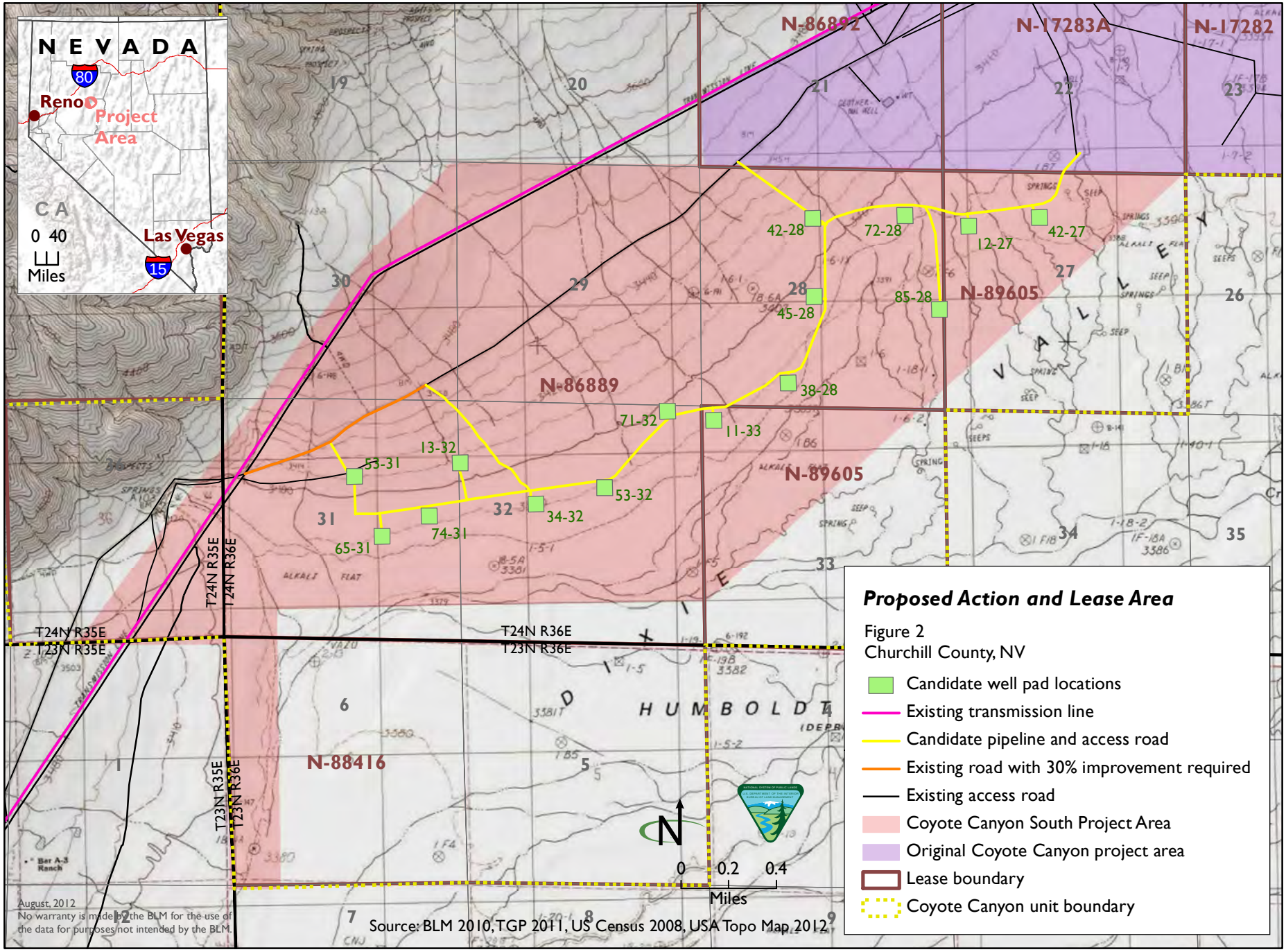
Copies of the stipulations for all three leases are attached to this EA as **Appendix A**, Geothermal Leases and Stipulations. TGP is required to comply with all lease stipulations.

The Proposed Action would be subject to other applicable state and local permits listed in **Table 2**, List of Federal and State Permits, prior to beginning construction.

Table 2: Potential Regulatory Permits and Approvals for the TGP Dixie Development Company, LLC Coyote Canyon South Geothermal Exploration Project

Regulatory Agency	Authorizing Action
BLM	Access Road Right-of-Way
BLM	Notice of Intent
BLM	Geothermal Drilling Permit
BLM	Contract for the Sale of Mineral Materials
Nevada Division of Minerals	Application for Permit to Drill an Oil and Gas and Geothermal Well
Nevada Department of Environmental Protection – Bureau of Water Protection Control	Construction Stormwater Permit
Department of Conservation and Natural Resources, Nevada Division of Water Resources	Temporary Consumptive Water Use permit
Nevada Department of Conservation and Natural Resources, Division of Environmental Protection, Bureau of Air Pollution Control	Surface Area Disturbance Permit
BLM, Nevada Division of Historic Preservation and Archaeology	Section 106 compliance with the National Historic Preservation Act


Project Location and Gravel Sources
Figure 1
Churchill County, NV
Coyote Canyon unit boundary
Coyote Canyon South project area
Aggregate pits
0 2 4
Miles
N
Source: TGP 2011, ESRI Shaded Relief 2011
29N 33E
29N 34E
29N 35E
29N 36E
29N 37E
28N 33E
28N 34E
28N 35E
28N 36E
27N 33E
27N 34E
27N 35E
27N 36E
26N 33E
26N 34E
26N 35E
26N 36E
26N 37E
26N 38E
26N 39E
25N 33E
25N 34E
25N 35E
25N 36E
25N 37E
25N 38E
25N 39E
24N 33E
24N 34E
24N 35E
24N 36E
24N 37E
24N 38E
24N 39E
23N 33E
23N 34E
23N 35E
23N 36E
23N 37E
23N 38E
23N 39E
22N 33E
22N 34E
22N 35E
22N 36E
22N 37E
22N 38E
22N 39E
21N 35E
21N 36E
21N 37E
21N 38E
21N 39E
20N 35E
20N 36E
20N 37E
20N 38E
20N 39E
19N 35E
19N 36E
19N 37E
19N 38E
19N 39E
PERSHING COUNTY
CHURCHILL COUNTY
PERSHING COUNTY
CHURCHILL COUNTY
STILLWATER RANGE
DIXIE VALLEY
CLAN ALPINE MOUNTAINS
EDWARD CREEK VALLEY
Lovelock-Unionville Rd
Rochester Canyon
Old Emigrant Rd
Coal Canyon-Stillwater Rd
Kitten Springs Rd
Grass Valley Rd
Dixie Valley Rd
Alpine Rd
Valley Rd
80
50
15
NEVADA
UT
CA
AZ
Reno
Project Area
Las Vegas
0 60
Miles
August, 2012
No warranty is made by the BLM for the use of the data for purposes not intended by the BLM.



Proposed Action and Lease Area

Figure 2
Churchill County, NV

- Candidate well pad locations
- Existing transmission line
- Candidate pipeline and access road
- Existing road with 30% improvement required
- Existing access road
- Coyote Canyon South Project Area
- Original Coyote Canyon project area
- Lease boundary
- Coyote Canyon unit boundary

2.0 PROPOSED ACTIONS AND ALTERNATIVES

This chapter presents the Proposed Action and the No Action Alternative.

2.1 PROPOSED ACTION

TGP proposes to construct up to 15 wells pads and may drill up to three wells per pad for geothermal resource exploration. TGP would drill either small diameter explorations wells (slim wells) or full-size exploration wells (exploration wells). The primary objective of the project is to further evaluate the characteristics of the geothermal resources in the Project Area. The proposed action consists of:

- Constructing new access roads;
- Upgrading existing access roads;
- Constructing up to 15 well pads;
- Drilling and completing slim wells or exploration wells;
- Flow testing exploration wells to determine commercial potential;
- Constructing a temporary personnel camp; and
- Extracting gravel from three gravel pits.

2.1.1 Overview and Location of Proposed Action

The project site is located in Dixie Valley, Churchill County, Nevada and is shown in Figure 1, Project Location and Gravel Sources.

The Proposed Action includes drilling up to 15 slim wells or exploration wells in the Project Area. Slim wells would be to depths of 6,000 feet with a maximum diameter of 14 inches, and exploration wells would be to depths of up to 10,000 feet with a maximum diameter of approximately 30 inches. Multiple wells could be drilled within the footprint of one well pad which would reduce the total number of well pads needed and reduce the area needed to be disturbed. Potential well pad locations and access roads have been placed based on geological information gathered at the sites and with a goal of minimizing environmental impacts. Each drill site would explore a specific geological target. Drill sites were proposed to avoid or minimize environmental issues or constraints identified through the environmental assessment process described in this report.

The wells would be used to provide lithologic and stratigraphic information and to measure the temperature and geochemistry of subsurface fluids at various depths in the wells. Well flow tests would be conducted on selected exploration wells to confirm resource production and generating capabilities and to identify eventual production and injection well top and bottom hole locations.

Following well installation, temperature gradients would be measured and performance testing would be completed in the slim wells and exploration wells. TGP would determine resource production and generating capabilities from the data collected. Drilling operations would be conducted in accordance with BLM and Nevada Division of Minerals regulations and permit requirements. If well conditions warrant changes to the design for completion of a well, any

required approval from the responsible regulatory agency would be sought prior to making the changes.

The Lease Area consists of approximately 7,588 acres in Churchill County, Nevada (see Figure 1, Project Location and Gravel Sources). TGP proposes to conduct geothermal exploration in a portion of the Lease Area called the Project Area. The main Project Area consists of 3,530 acres. Figure 2, Proposed Action and lease Area, shows the Lease Area, the Project Area, and potential site layout.

TGP is proposing exploration activities at up to 15 potential well locations. Specific well locations, potentially including up to three wells at a single drill pad, would be determined during field activities based on observations during drilling. In addition to drilling and testing geothermal exploration wells, the Proposed Action involves the construction of access roads and drilling pads. Supporting facilities would also be constructed to support well drilling and testing. Well installation and road construction would disturb approximately 68 acres. These facilities are described in Sections 2.1.3, Site Access and Road Improvements, and 2.1.5, Site Preparation Activities.

The legal description of the proposed exploration well pad locations at CCS and the corresponding Kettleman well numbers is provided in **Table 3**, Exploration Well Pad Locations.

Table 3: Exploration Well Pad Locations

Lease Number	UTM X	UTM Y	Township Range	Section	Modified Kettleman
N-89605	421404	4419734	T24N R36E	27	42-27
N-89605	420927	4419684	T24N R36E	27	12-27
N-86889	419879	4419755	T24N R36E	28	42-28
N-86889	420499	4419762	T24N R36E	28	72-28
N-86889	419879	4419227	T24N R36E	28	45-28
N-86889	420720	4419128	T24N R36E	28	85-28
N-86889	419694	4418650	T24N R36E	28	38-28
N-89605	419188	4418408	T24N R36E	33	11-33
N-86889	418879	4418474	T24N R36E	32	71-32
N-86889	418446	4417967	T24N R36E	32	53-32
N-86889	417477	4418151	T24N R36E	32	13-32
N-86889	417982	4417864	T24N R36E	32	34-32
N-86889	417263	4417797	T24N R36E	31	74-31
N-86889	416942	4417666	T24N R36E	31	65-31
N-86889	416764	4418073	T24N R36E	31	53-31

2.1.2 Schedule of Exploration Activities

The applicant proposes to start exploration drilling activities as soon as possible following BLM approval and Nevada Division of Minerals permit issuance. The exploration drilling activities would be completed within 2 years of permit issuance. Reclamation activities would be

conducted as described in Section 2.1.9, Plans for Surface Reclamation, over an approximately 3-year period following completion of drilling and testing.

2.1.3 Site Access and Road Improvements

Existing access roads would be used to the extent possible, and upgraded as necessary to support construction and operational vehicle traffic. The primary access to the leased areas would be via US Route 50. From Route 50, Highway 121 leads to the leased areas. Access roads, where not already in existence, would be provided to interconnect the different lease parcels. Each well pad site would be built directly adjacent to the access road, eliminating the need for any branch access roads. New access roads would be constructed as part of each Proposed Action according to the following specifications:

- Roads would be 35 feet wide, including travel way, shoulders, and drainage ditches. Roadways would have a travel way of up to 25 feet with 2-foot shoulders and 3-foot drainage ditches on either side. In areas where roads need to be built up with several feet of aggregate and would have fill slopes of 2 to 1, the travel-way width would be reduced down to a minimum of 15 feet to free up space to accommodate the slopes. Road designs, including road cross-section and crowns, rolling dips, culvert designs and placement, and road plans and profiles would be executed in keeping with Gold Book standards.
- Aggregate would be applied to the maximum 25-foot wide travel way and shoulders with an average of two feet of aggregate base course. To include a generous buffer in aggregate calculations, a 35-foot wide roadway was used. The proposed access roads would require approximately 81,000 cubic yards of gravel.
- Well pads would be used as turnouts since most of the proposed well pads are located directly adjacent to the road.
- 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.
- Where rolling dips are not feasible, culverts would be installed along new access roads in areas of low spots or existing ditches as needed. The culverts would be designed to accommodate flows from at least a 25-year storm event. Exact locations of culverts are yet to be determined, but would be provided to the BLM once the final design is complete.
- Cut-and-fill requirements would be minimal and balanced where possible. The roads would be graded to follow existing topography in order to minimize cut and fill requirements.
- Cross-country access roads are not anticipated as part of the Proposed Action.

Up to 5.9 miles of access roads would be constructed for a total disturbance of up to 25 acres as shown in **Table 4**, Summary of Disturbed Acreage. Well pads are described in Section 2.1.8, Well Pad and Drilling Operations, and **Figure 3**, Typical Well Pad Layout.

Table 4: Summary of Disturbed Acreage

Disturbance Type	Length of Access Roads	Dimensions of Disturbed Areas[1]	Acres Disturbed
Observation Well Footprint (Total of 15 wells)[1]	NA	350 feet by 350 feet (2.8 acres each)	42.0
Water Well for Monitoring and/or Potential Plant Use	NA	150 feet by 150 feet	0.5
Access Roads and Temporary Pipelines	5.9 miles	5.9 miles by 35 feet	25.0
Gravel Pit Expansion	NA	Up to 15 acres per site	45.00
		Total Disturbed Acreage:	112.5

[1] The well pad dimensions include space for storage of drilling equipment, drilling vehicles, and storage of topsoil and spoil material. Laydown areas that would be required for drilling operations would be located on each of the well pads as indicated on Figure 3.

2.1.4 Land Ownership and Rights-of-Way

The exploration wells and access roads would be located wholly on land administered by the BLM and leased for exploration activities to TGP. Because Highway 121 passes through the Lease Area, no new access roads outside the Lease Area would be needed.

2.1.5 Site Preparation Activities

Site preparation activities would include setup of a temporary worker camp and transport and staging of equipment required for exploratory drilling. Staging areas would be established at the temporary worker camp and at the initial well pad locations. In addition, measures would be set up to ensure proper management of hazardous materials and wastes that would be used and generated during implementation of the Proposed Action.

2.1.5.1 Temporary Worker Camp

During drilling operations a temporary worker camp would be set up at existing inactive well pad 36-14 within the Coyote Canyon lease area to the north to provide accommodations for drill crews and subcontractors. Access to the camp would be by roads already developed for access to that inactive well pad. No additional area would be disturbed for use of the camp.

The camp would comprise self-contained trailers used for offices and prefabricated modules (estimated size up to 12 by 60 feet) for lodging. The camp would typically comprise one to two sleeping modules with a centralized kitchen, dining, and recreational area. The camp components would be transported to the site by trailer along the existing access road and proposed access roads. Up to two 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 up to two portable generators.

Communication among field operations, TGP offices, BLM, and Nevada Division of Minerals offices would be maintained using radio and satellite telephones. Support facilities and equipment would be located on the personnel camp pad.

2.1.5.2 Equipment

Each drill site would be prepared to create a level pad for the drill rig and a graded surface for the support equipment. Support equipment used during exploratory drilling activities includes:

- Standby and start-up diesel generator;
- Air compressors;
- Geothermal rotary drilling rigs;
- Personnel vehicles (pick-up trucks); and
- Construction equipment, including dump trucks, road graders, and bulldozers.

2.1.5.3 Staging Areas

Equipment and supplies required for implementation of the Proposed Action would be staged either at the temporary worker camp, at the active well pad, or at an inactive well pad location. No additional areas would be disturbed beyond those shown in Table 4. In particular, no more than 15 well pad locations would be disturbed either by construction of well pads or by temporary use as staging areas.

2.1.5.4 Waste and Hazardous Materials Management

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 onsite during construction and drilling activities to provide prompt response to accidental leaks or spills of chemicals and petroleum products.

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.

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.

2.1.6 Aggregate Supply for Road and Pad Construction

It is anticipated that total aggregate needs for the project site would be less than 150,000 cubic yards with total new surface disturbance of up to 45 acres across 3 sites. **Table 5**, Summary of Aggregate Requirements, summarizes the maximum potential aggregate needs of access roads and well pads.

Table 5: Summary of Aggregate Requirements

	Length	Width (feet)	Depth (inches)	Total Aggregate (cubic yards)
Access Roads (includes branch roads)	5.9 miles	35	24	80,764.4
Access Roads with 30% Improvement	0.8 mile (30% = 0.24 mile)	35	6	821.3
Observation Well Pads Centerline (15)	110 feet	350	36	64,166.7
Well Footprint (15)	40 feet	40	48	3,555.6
Total Aggregate Required:				**149,308**

The majority of aggregate material for the road and well pad surfaces would be obtained under existing and three proposed mineral material contracts from three BLM gravel sites. Expansion of these gravel sites is proposed as part of this project. These gravel sites were selected due to the quality of gravel at each site as well as the proximity to the Project Area. An overview of the location of these pits is provided in Figure 1, Project Location and Gravel Sources. Maps focusing on each of the three and are provided in **Figures 4**, **5** and **6**. The existing gravel contract is located within the Dixie Valley Community Pit in SW1/4 Sect. 16, T24N, R36E. The three areas identified for gravel extraction as part of this project are:

1. Expansion of Cottonwood Canyon gravel pit in SW/4 SE/4 Sec. 1, T24N, R36E (see Figure 4); and
2. Expansion of the Dixie Valley Community Pit in SW1/4 Sect. 16, T24N, R36E (see Figure 5);
3. Development of an unnamed gravel pit area in SW SE S. 11, T24N, R37E (see Figure 6). TGP would avoid the SW SW SE of Sec. 11 where TGP has a gravel contract, or as guided by BLM.

TGP would apply for gravel contracts at any of the three identified gravel pit locations to meet the gravel needs for the project. If better quality aggregate is needed to augment the gravel sourced from local BLM pits, TGP may acquire additional gravel from private sources not in the vicinity of the Project Area. All three gravel pits would be accessed via existing roads.

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 deposit. 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 to the

surrounding area. Water sprays would be used during all phases of material handling to reduce fugitive dust. Water trucks from the existing Dixie Valley plant would be used for dust abatement. The water would come from domestic water wells or cooling tower blowdown. 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.

The community gravel pit would be used on a first come first use basis to minimize congestion within the pit area by different users. Slopes would be re-contoured as needed to minimize collapse. Regular reports of use would be submitted according to permit terms.

Construction at the gravel sources would occur incrementally as the gravel demands of the project dictate. During construction, vegetation would be removed and topsoil would be salvaged where possible and stockpiled for use during reclamation. Excavation of the gravel source area would reach depths no greater than 10 feet below ground surface. A safety fence would be installed along the perimeter of the gravel source area once excavation reached depths greater than or equal to 3 feet below ground surface. TGP would not locate any geothermal or water wells in the gravel source area.

Reclamation of the aggregate pit will consist of leveling any stockpile material, reducing the slopes in the pit to 3:1, removing all trash and debris, and re-seeding if necessary. If BLM determines there is a future need for the aggregate pit, revegetation of the pit surface will not be necessary.

2.1.7 Water Supply for Grading, Drilling and Dust Abatement

Water would be required for drilling operations as well as for construction and compaction of roads, pads, sumps, and dust control. Up to 20,000 gallons per day could be required for each observation well throughout the eight-week period during which it would be drilled. One or more portable water tanks holding a combined total of at least 10,000 gallons, but not more than 60,000 gallons, would be maintained on the well sites during drilling activities. Bottled drinking water would be provided for construction and drilling personnel. TGP would obtain drilling water from its nearby, existing Dixie Valley power plant, or from new wells under a Nevada Division of Water Resources temporary waiver. Piping currently extends from the power plant to existing well 76-14. TGP would install additional, aboveground, approximately 8-inch diameter black piping along the proposed access roads from this polyline to well sites or truck water from the water line termination point. Various factors such as topography and distance would help determine water line locations, with an emphasis on minimizing surface disturbance.

TGP may also install groundwater observation wells in the Project Area to determine the availability of water and the quality of available water for future activities such as groundwater monitoring, plant domestic or potential injection augmentation. One or more of these water wells may be used under a temporary water permit for well drilling from the Division of Water Resources. The groundwater aquifer is expected to be at a depth of approximately 500 feet below ground surface. TGP would locate each exploratory water well within the survey area. It is

estimated that a pad measuring 150 feet by 150 feet (0.52 acre) would be required to support drilling for each water well. In addition, a sump for drill cuttings and pump test water may be required. The sump would measure approximately 50 feet long by 15 feet wide by 10 feet deep. Alternately, portable tanks may be used for well drilling, which would help minimize pad size and resulting surface disturbance by removing the need for a sump. BLM and NDEP approval would be required for the temporary surface discharge from flow testing of the groundwater wells. The exact location of each water well has yet to be determined but would be located in the surveyed areas adjacent to existing access roads. The sump would be maintained subsequent to drilling for the storage of water. Water from each well would either be trucked to the well pad sites or would be piped using aboveground, approximately 8-inch diameter black piping that would be installed along the proposed access roads. No new roads would need to be constructed in order to install the water well. Use of the water well would also enable better quality sampling and chemical analysis for monitoring purposes.

As explained in Section 2.1.6, dust abatement during gravel extraction from the gravel pits would use water trucks from the existing Dixie Valley plant. The water would come from domestic water wells or cooling tower blowdown. The amount of water would minimal since it would only be needed for dust abatement and for the duration of time that gravel extraction would occur.

2.1.8 Well Pad and Drilling Operations

This section describes construction of well pads, which would be constructed at each location where slim wells or exploration wells would be drilled, along with a summary of the drilling process.

2.1.8.1 Well Pad Layout and Design

Figure 3 shows a typical well pad layout for slim wells and exploration wells. Each well pad would be 350 feet by 350 feet. The well pad would accommodate the drilling rig, sump, and support equipment and vehicles necessary during drilling. The orientation of the individual well pads would be determined by engineers in the field before construction. The proposed well pad locations are located in the relatively flat Dixie Valley with topography that gently slopes northwest toward the Stillwater Range within the Lease Area (see Figure 2, Proposed Project and Lease Area). Because of the existing topography, there would be no need to construct well pads on steep slopes or narrow ridges.

Any fill slopes that may be constructed as a part of well pad grading would be 2 horizontal to 1 vertical or greater, as necessary, and would be compacted and maintained to minimize erosion and provide slope stability. The natural washes within the Lease Area are ephemeral, with intermittent flows only from substantial rainfall or snowmelt events. The well pads would be constructed to avoid the ephemeral washes to the extent practicable. The well pads would be graded so that cut-and-fill requirements would be balanced and no offsite fill material would be needed. Per the Riparian Areas Stipulation on leases N-88416 and N-89605, no surface occupancy or disturbance is allowed within 650 feet (horizontal measurement) of the mapped waters and 100-year floodplains within the Lease Area.

A fenced sump would be excavated on each well pad for the storage of drilling muds and fluids, flow test fluids, and drill cuttings in accordance with the applicable best management practices (BMPs) identified in the *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development Activities* (Gold Book) (BLM 2007). TGP would comply with both federal and Nevada Department of Environmental Protection (NDEP) requirements for sump grading. Sumps would be netted to exclude birds should harmful properties occur in the geothermal fluids. Each sump would have up to one million gallons of capacity, and the interior would measure approximately 320 feet long, 125 feet wide, and 3.34 feet deep below grade with another 2 feet of freeboard. Actual depth of excavation for each sump would depend on the depth necessary to stay above the standing water level. Sumps would be compacted during construction, and settled bentonite clay from drilling mud would accumulate on the bottom of the sump to act as an unconsolidated clay liner which would then serve to minimize percolation. A berm would be constructed around the outer edges of the sump and would measure approximately 4 feet wide by 2 feet tall. Material from sump excavation would be used in the construction of the berm. After the well pad has been graded and spoils from the well pad sump excavation have been laid down for leveling, an average of three feet of gravel would be placed over the areas where the drilling work would be conducted, an area that measures approximately 110 feet by 350 feet. Topsoil from the excavated sump would be conserved by spreading it around the well pad laydown area surface soil. Use of the sumps would be conducted under a permit from NDEP. The well footprint (estimated at approximately 40 feet by 40 feet) would require additional stabilizing for heavier equipment and would have an additional two feet of compacted aggregate for a total average of five feet of compacted aggregate. A typical well pad layout and design is provided in **Figure 3**, Typical Well Pad Layout.

The volume of gravel necessary for all 15 proposed well pads would be approximately 64,200 cubic yards, assuming all are constructed to the maximum proposed size of 2.8 acres. This estimate includes an extra one foot of gravel for the 40-foot by 40-foot well footprint.

Stormwater runoff from undisturbed areas around the constructed drill pads would be directed into ditches surrounding the well pad and back onto undisturbed ground. The ditches would be constructed consistent with BMPs for storm water and erosion control.

Upon completion of the drilling operations, clean-out and flow tests would be performed on the wells. Flow testing would typically run for an average of three days (24 hours per day) for each well, but the duration may vary depending on well characteristics. During these tests the flow would be routed to the sumps. It is anticipated that the initial flow rates of fluid from each well into its sump would be approximately 500 to 1,500 gallons per minute on average depending on the productivity of the well.

During flow testing, additional sump capacity may be required depending on well production rates. To provide this additional sump capacity, TGP would use existing sumps at their Dixie Valley power plant located approximately 2.5 miles north of the CCS site along Dixie Valley Road. Excess fluids from flow testing each well would be either trucked or piped using temporary piping laid on the surface to existing well sumps at the Coyote Canyon project.

Well Pad Disturbed Areas

The Proposed Action includes development of up to 15 slim or exploration wells in each project area. Figure 2, Proposed Project and Lease Area, shows potential locations for the wells. Revisions to the specific proposed well locations within the project area could occur as new information becomes available from initial drilling and testing results. Disturbance calculations for each well pad shown in Table 4 includes staging and laydown requirements for equipment, supplies, and stockpiled soil and aggregate required for well drilling and access road construction. No additional disturbance would occur for staging and storage requirements.

Construction of each of the well pads would disturb up to 2.8 acres, for a total of up to 42.0 acres of disturbance for the 15 wells at Coyote Canyon. Table 4 presents the acreage of disturbance associated with exploration well pads, including staging areas.

2.1.8.2 Drilling Operations

A detailed geothermal drilling program would be submitted to the BLM for review and approval prior to beginning operations. This section summarizes drilling activities for slim wells and exploration wells 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 within the geothermal drilling permit.

Each well would be drilled using a large diesel auger drilling rig with a power rating ranging from 1,000 to 3,000 horsepower. During drilling, the top of the drill rig derrick would be up to 160 feet above ground surface depending on the rig used. The typical drill rig and associated support equipment (for example, rig floor and stands; draw works; mast; drill pipe, trailers; mud, fuel, and water tanks; diesel generators; air compressors) would be brought to the prepared pad on large tractor-trailer trucks. An average of six to eight small trucks, service vehicles, and worker's vehicles could be driven to the active well site each day throughout the typical 8-week drilling process. Difficulties encountered during the drilling process, including the need to work over or to re-drill the well, could double the time necessary to successfully complete a full-size observation 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 on site at a time but TGP may elect to drill up to three wells at once, bringing the total crew to as many as 36.

Crews would include the drilling supervisor, geologists, suppliers, and operators. If well conditions warrant changes to the design for completion of a well, required approvals from the responsible regulatory agency would be sought before making the changes.

Well stimulation operations could involve placing a dilute mixture of hydrochloric (muriatic) acid down the well. The amount of dilute acid placed in the well bore (which can vary from 10,000 gallons to 50,000 gallons or more) is determined by calculating the amount of each type of mineral to be dissolved. Concentrated hydrochloric acid (35 percent) would be trucked to the site and mixed onsite with water by experienced contractors. The dilute acid mixture would be placed in the cased well bore, followed by water to push the mixture into the geothermal reservoir. After dissolving the minerals in the geothermal reservoir, the water and now-spent acids would be flowed back through the well to the surface where they would be tested,

neutralized if necessary (using sodium hydroxide or crushed limestone or marble), and discharged to the sump.

Standard aquifer testing procedures would be employed at targeted depth intervals as the boreholes for exploration wells are advanced. The vertical boundaries of the aquifers, the depth of aquifers (non-thermal and thermal) penetrated during drilling, would be noted from the drilling log. The horizontal boundaries would be noted if any are reflected on time-drawdown plots produced during aquifer testing. Borehole geophysics analysis would be conducted from the ground surface to the total depth of the borehole. Aquifer testing would be used to determine drawdown associated with pumping. If possible, an assessment of whether the aquifer is confined or unconfined would be made, as well as an estimate of aquifer thickness and a qualitative assessment of its relative productivity. The temperature of penetrated aquifers would be noted.

Selected wells, identified in the Hydrologic Monitoring Plan prepared for the Coyote Canyon project and determined in consultation with BLM, would be monitored for water table level and water quality prior to and during the Proposed Action.

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 onsite during construction and drilling activities to provide prompt response to accidental leaks or spills of chemicals and petroleum products.

TGP may decide to conduct directional drilling at each site based on the location and extent of geothermal resources in proximity to the well site. Directional drilling would likely result in a deep bottom hole located under BLM lease areas. TGP Geothermal Drilling Permit applications would be submitted to the BLM for the drilling of these wells, pursuant to 43 CFR 3260.11

2.1.9 Plans for Surface Reclamation

If exploration activities confirm the expected commercial viability of the resource, TGP plans to build and operate a geothermal power plant to generate and sell renewable energy. In that case, TGP would submit an application for regulatory approvals to place the wells, associated access roads, and other components required to operate the facility into commercial service. The wells would be monitored and exploration activities would continue in accordance with these plans while the application is processed. Interim reclamation activities would be implemented as described below. 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 BLM Gold Book recommendations. A final drill site/access road reclamation plan may be developed depending upon final well locations and as required by BLM (BLM 2007). The following information is provided for purposes of evaluating potential environmental impacts from the Proposed Action.

Reclamation could also be required for the aggregate source areas and would be described and conducted in accordance with a separate plan as part of permits and sale agreements issued for that purpose.

BLM will include any additional provisions and conditions needed to address environmental concerns or other site-specific issues with the geothermal drilling permits.

2.1.9.1 Interim Reclamation

During the life of the project, all disturbed areas not needed for active support of operations would undergo interim reclamation. During the construction process, topsoil would be salvaged where possible and stockpiled for use during reclamation. Following completion of well testing, drilling and testing equipment would be removed from the site. With the exception of an area required to access maintained wellheads, cut and fill slopes would be recontoured to a final or intermediate contour that blends with the surrounding topography and erosion control BMPs would be implemented. Topsoil would be respread over areas not needed for operations and revegetated, if requested by the BLM, to within a few feet of the area required to access and maintain the wellhead.

Surface facilities selected to remain on site for future production or injection wells would consist of a wellhead and potential monitoring equipment. 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 well pads and access roads would be left in place and subject to regular inspection and maintenance by TGP personnel, until such time BLM, with input from TGP, directs TGP to reclaim these areas. Portions of the access roads not needed for future vehicle travel may be reclaimed as part of interim reclamation processes. If the well pad is deemed by TGP to be unnecessary or the geothermal lease is released back to the BLM, whichever occurs first, then final reclamation activities would be conducted as described below.

The temporary groundwater well would either be abandoned following completion of exploration activities, in accordance with Nevada regulations, or could be converted to permanent use for the facility. If the well is suitable for long-term use, TGP would obtain the necessary permits from the Nevada State Engineer prior to such use.

2.1.9.2 Final Reclamation

Final reclamation would consist of two steps: well reclamation and road reclamation.

Road Reclamation. Following completion of project activities, access roads would be reclaimed by 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 the 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 the BLM's direction.

TGP would maintain healthy, biologically active topsoil and minimize habitat, visual, and forage loss during the life of the wells by stockpiling and spreading any extra salvageable topsoil over the area of interim reclamation whenever possible.

Well Site Reclamation. After well operations have ceased and prior to the geothermal lease being released back to the BLM, TGP would reclaim the Project Area by capping and sealing off the wells below ground level in compliance with BLM and Nevada Division of Minerals regulations. Reclamation would be complete to standards considered acceptable to the BLM Authorized Officer. Large areas of gravel fill may need to be removed. Where cut and fill had occurred as part of the project, the area would be recontoured to blend with the surrounding topography. TGP would resurface well pads with stockpiled topsoil where available and reseed with a mix specified by the BLM and free of noxious weeds at the time of reclamation. Any culverts that may have been installed would be removed. 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 during reclamation activities. If available, topsoil would be respread evenly over the surfaces of the disturbed areas and be reseeded with a mix specified by the 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. Where areas have been surfaced with gravel, the gravel would be buried deep in the recontoured cut to prevent possible surface exposure and sumps would be backfilled after they are dry and free of waste and graded to conform to the surrounding terrain.

2.1.10 Standard Operating Procedures, Best Management Practices, and Proposed Mitigation

TGP would comply with the special lease stipulations attached to federal geothermal leases (see Appendix A).

Standard operating procedures and BMPs would reduce the effects on the human and natural environment. In addition to procedures identified in The State of Nevada State Conservation Commission's Best Management Practices Handbook (1994) and the conditions of approval identified in the Coyote Canyon and Dixie Meadows Geothermal Exploration Environmental Assessment (BLM 2010), Finding of No Significant Impact and Decision Record, 2010, the following mitigation measures would be followed to reduce any impacts:

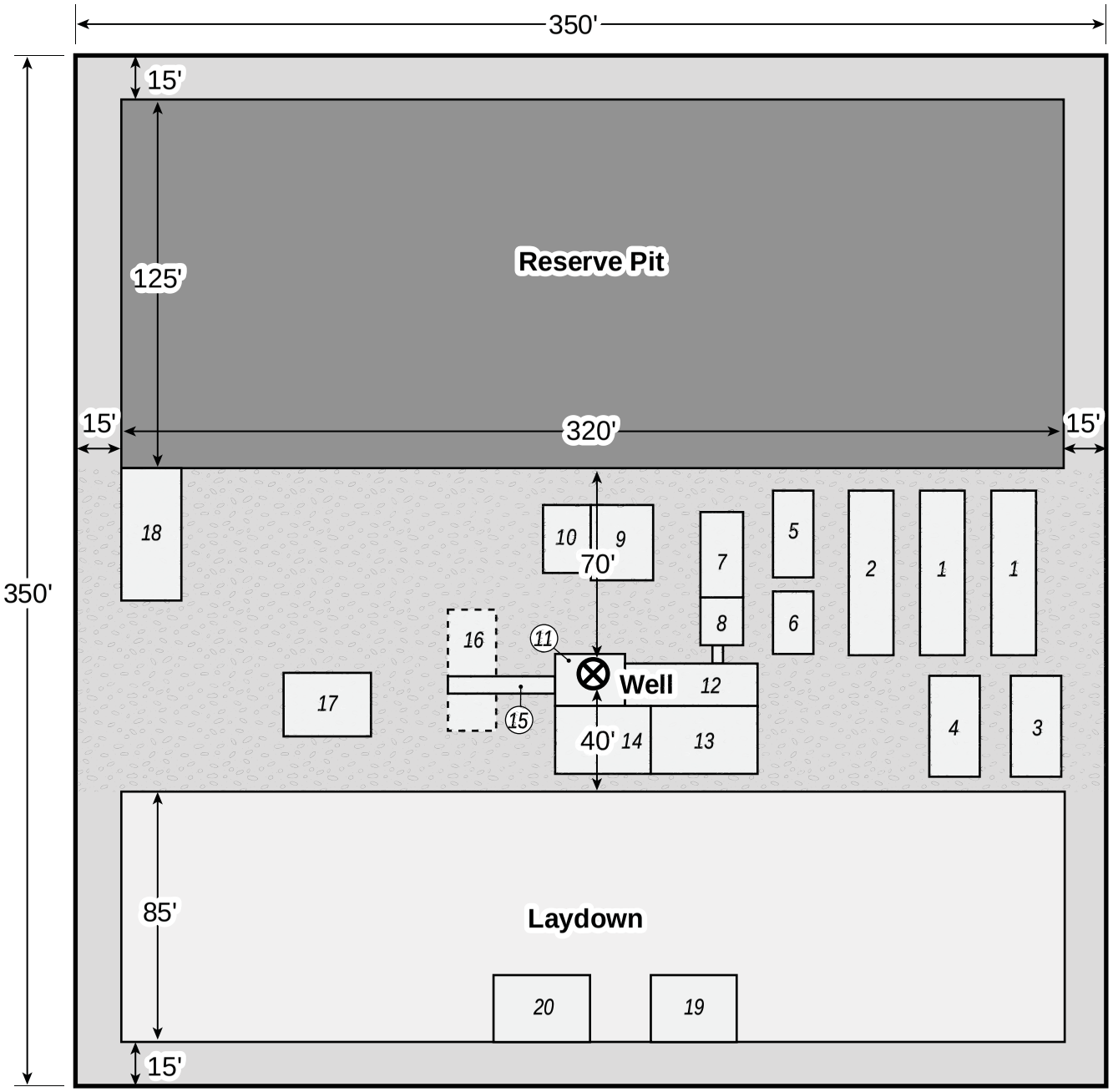
- TGP would comply with any requirements prescribed by the Nevada Division of Environmental Protection-Bureau of Air Pollution Control.

- Dust abatement techniques, such as watering on unpaved, unvegetated surfaces, would be used during construction to minimize airborne dust.
- Speed limits would be posted and enforced during construction and operation to reduce fugitive dust (speed limit of 25 miles per hour within the project site, as necessary).
- Equipment and vehicle idling times during construction activities would be minimized.
- The Proposed Action would be designed to avoid sites determined eligible for listing on the National Register of Historic Places.
- A 30-meter buffer would be placed around identified historic properties to avoid adverse effects.
- Wells would be grouted and cased so that flood water could not penetrate if well pads are inundated. Construction equipment would be cleaned prior to project work (may be washed in Fallon prior to deployment)
- Existing weed infestations would be treated prior to disturbance. The location of the weeds would be communicated to the Stillwater Field Office weed coordinator, and treatment methods and herbicides used would be discussed prior to treatment.
- Herbicides would be applied per label instructions.
- All personnel applying herbicides would either be certified by the BLM and/or the State of Nevada, or they would be supervised by a BLM or State of Nevada Certified Applicator.
- Bureau 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 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).
- Components of the Proposed Action that would result in direct habitat loss within migratory bird nesting habitat would either occur prior to the nesting season or nest surveys would be conducted by a qualified biologist acceptable to the BLM prior to implementation. If nests are found, coordination with the BLM would occur to develop appropriate protection measures, which may include avoidance, timing constraints, and/or buffers.
- Sumps would be fenced to excluse humans and wildlife, and if harmful properties occur in the geothermal fluids, the sumps be netted to exclude birds.
- Adhere to Suggested Practices for Avian Protection on Power Lines (APLIC 2006) guidelines for design overhead utilities such as installation of perch deterrents.
- Hazardous materials would be properly stored in separate containers to prevent mixing, drainage or accidents. Hazardous materials would not be drained onto the ground or into streams or drainage areas.
- A Spill Prevention, Control, and Countermeasures plan would be developed, secondary containment structures would be used on site, and workers would be trained in spill prevention and cleanup methods.
- Solid wastes would be transported offsite to an authorized landfill.

- TGP and its contractors would avoid known eligible and potentially eligible cultural resource sites during all phases of the project.
- A 100-foot buffer zone would be established around eligible and potentially eligible cultural resource sites to help provide protection to the sites. The Proposed Action would not encroach into the established 100-foot buffer zone.
- The project facilities would be operated in a manner consistent with the engineered design to prevent problems associated with run-off that could affect adjacent cultural sites. This includes the use of acceptable erosion control methods that are applicable to the site conditions.
- Where the installation of project facilities could impact eligible or potentially eligible cultural sites(s), TGP would retain a qualified archaeologist to serve as a cultural monitor during construction of the facility in order to avoid potential effects to cultural site(s). The BLM would decide when cultural monitors are necessary.
- Vehicle and equipment travel would be limited to established roads and roads that are part of the Proposed Action.
- If human remains are identified during construction of any of the components of the Proposed Action, work within 300 feet of the discovery would be stopped and the remains would be protected from further exposure or damage. If the remains are determined to be Native American, the BLM would follow the procedures set forth in 43 CFR Part 10, Native American Graves Protection and Repatriation Regulations.

2.2 NO ACTION ALTERNATIVE

Section 1502.14(d) of NEPA's implementing regulations requires the alternatives analysis to "include the alternative of no action" as a baseline against which to assess impacts of the Proposed Action.



LEGEND

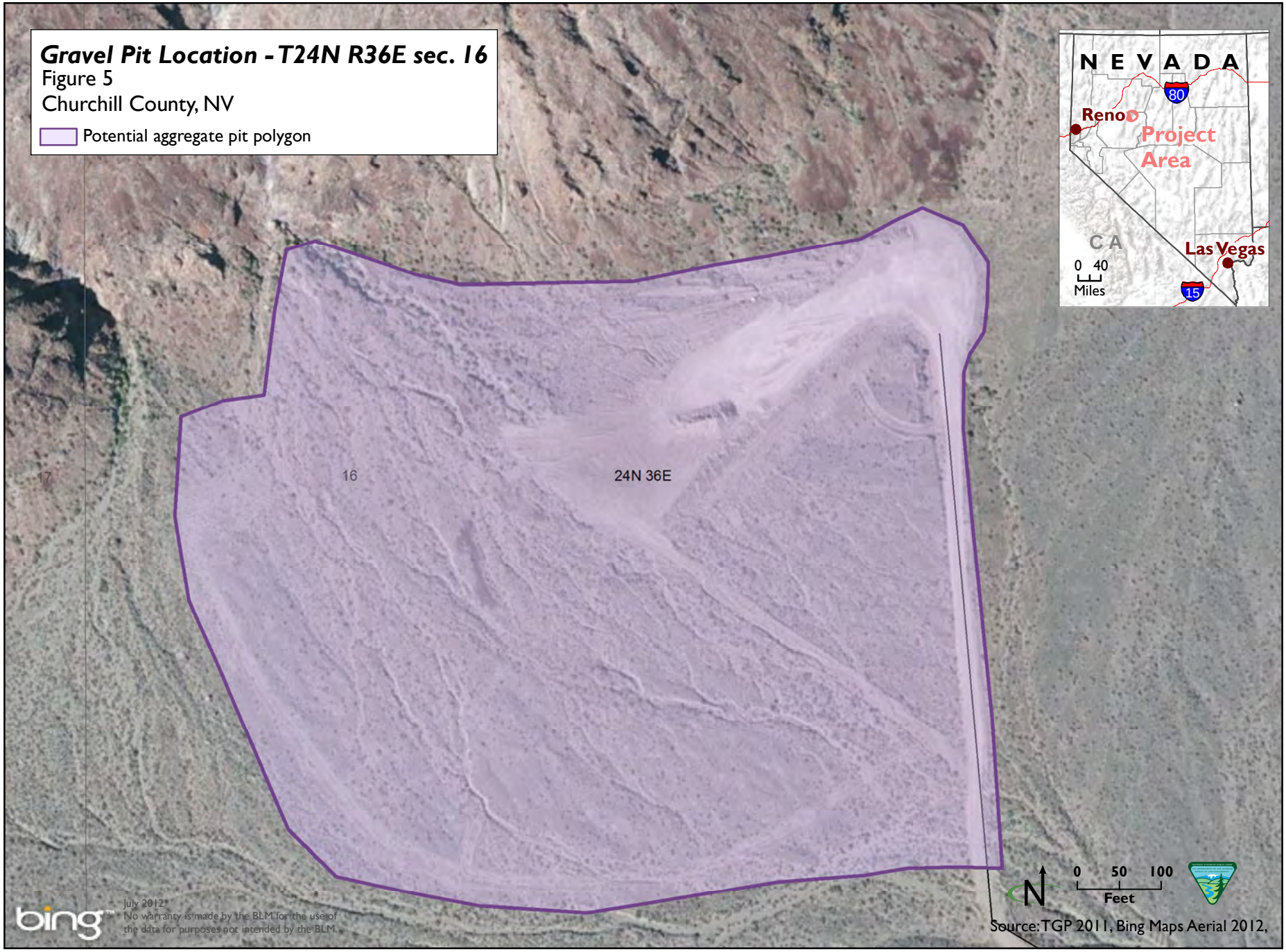
1 Air Compressors
2 Mud Tank
3 Fuel Tank
4 Water Tank
5 Mud Storage
6 Generator
7 Change House
8 Accumulator
9 Mud Pit
10 Shale Shaker
11 Rig Floor
12 Draw Works
13 Storage
14 Dog House
15 Catwalk
16 Pipe Rack
17 Electric Logger
18 Mud Logger
19 Trailer House
20 Trailer Office
Gravel Fill

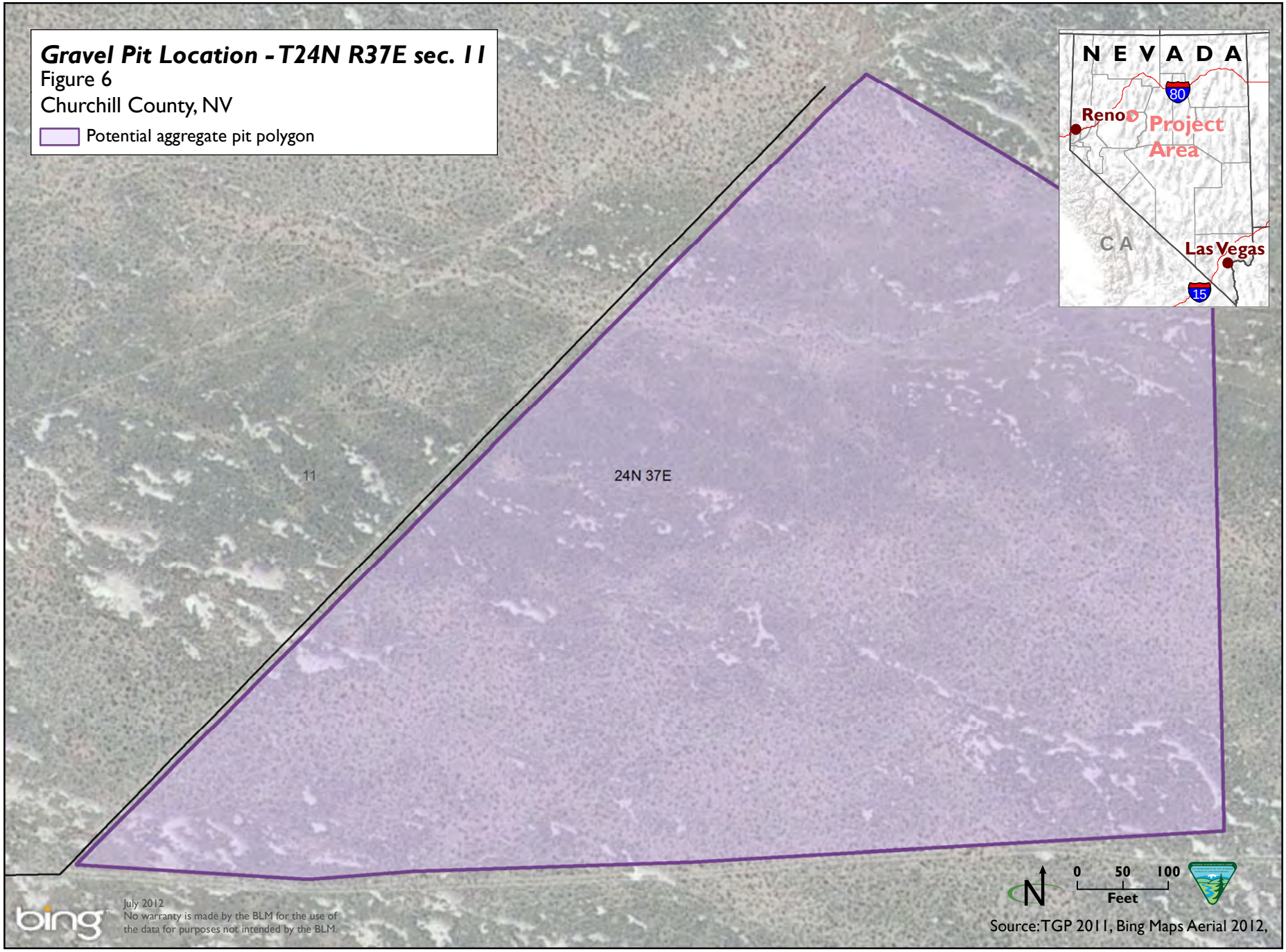
No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data for individual use or aggregate use with other data.

United States Department of the Interior
Bureau of Land Management
Stillwater Field Office
Carson City District Office
5665 Morgan Mill Road
Carson City, NV 89701

Figure 3
Typical Well Pad Layout
Coyote Canyon South Exploration Project
Plan of Operation

Gravel Pit Location - T24N R36E sec. 1
Figure 4
Churchill County, NV
Potential aggregate pit polygon
1
24N 36E
12
NEVADA
80
Reno
Project
Area
CA
Las Vegas
0 40
Miles
15
N
0 50 100
Feet
bing
July 2012
No warranty is made by the BLM for the use of
the data for purposes not intended by the BLM.
Source: TGP 2011, Bing Maps Aerial 2012,


Gravel Pit Location - T24N R36E sec. 16
Figure 5
Churchill County, NV
Potential aggregate pit polygon
NEVADA
80
Reno
Project Area
CA
Las Vegas
0 40
Miles
15
17
16
24N 36E
N
0 50 100
Feet
bing
July 2012
No warranty is made by the BLM for the use of the data for purposes not intended by the BLM.
Source: TGP 2011, Bing Maps Aerial 2012,


Gravel Pit Location - T24N R37E sec. 11
Figure 6
Churchill County, NV
Potential aggregate pit polygon
11
24N 37E
NEVADA
80
Reno
Project Area
CA
Las Vegas
15
N
0 50 100
Feet
July 2012
No warranty is made by the BLM for the use of the data for purposes not intended by the BLM.
Source: TGP 2011, Bing Maps Aerial 2012,

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section identifies and describes the current condition and trend of elements or resources in the human environment that may be affected by the Proposed Action or Alternatives and the environmental consequences or effects of the action(s).

3.1 SCOPING AND ISSUE IDENTIFICATION

The BLM SFO held an interdisciplinary team meeting on January 17, 2012. Per the Interdisciplinary Team Checklist for EA Preparation (included as **Appendix B**) and per BLM staff direction the following issues were identified as needing to be addressed in the EA: Air Quality; Floodplains; Water Quality; Visual Resources; ROWs/Lands; Minerals; Invasive, Nonnative and Noxious Species; Migratory Birds; Wetlands/Riparian Zones; Wildlife/Key Habitat; Special Status Species; Cultural Resources; and Native American Religious Concerns.

The following issues were identified as not being present in the Project Area: Areas of Critical Environmental Concern; Environmental Justice; Farm Lands; Forests and Rangelands; Human Health and Safety; Threatened and/or Endangered Species; Wild and Scenic Rivers; Wilderness; Lands with Wilderness Characteristics; Recreation; Wild Horses and Burros; and Livestock Grazing. Threatened and Endangered Species are discussed in this EA to clearly lay out the reason for a conclusion of no impact to this resource, in accordance with the Endangered Species Act.

3.1.1 Proposed Action General Setting

The Project Area is located in the western portion of Dixie Valley and is approximately 27 air miles northeast of Fallon, Nevada. The western edge of Dixie Valley is defined by the Stillwater Range and the eastern edge is defined by the Clan Alpine Mountains. The Project Area is located at elevations ranging from approximately 3,400 feet to 3,600 feet in the northern part of Dixie Valley.

3.1.2 Supplemental Authorities

Appendix 1 of BLM's NEPA Handbook (H-1790-1) identifies supplemental authorities that are subject to requirements specified by statute or executive order and must be considered in all BLM environmental documents (BLM 2008b). Supplemental authorities that may be affected by the Proposed Action are listed in **Table 6**, Supplemental Authorities and Rationale for Detailed Analysis for the Proposed Action, and further described in this EA.

Table 6: Supplemental Authorities and Rationale for Detailed Analysis for the Proposed Action

Elements[a]	Not Present[b]	Present/Not Affected	Present/May Be Affected[c]	Rationale
Air Quality			X	Carried through EA.
Areas of Critical Environmental Concern	X			
Cultural Resources[d]		X		Survey of project area and gravel areas revealed no eligible sites.
Environmental Justice	X			
Farm Lands (prime or unique)	X			
Floodplains		X		No proposed activities within mapped floodplains. Discussion provided in EA.
Invasive, Nonnative Species			X	Carried through EA.
Migratory Birds			X	Carried through EA.
Native American Religious Concerns[d]	X			Several field trips with Fallon Paiute Shoshone Tribe cultural coordinator; no concerns.
Threatened and/or Endangered Species (animals)	X			
Threatened and/or Endangered Species (plants)	X			
Wastes, Hazardous or Solid		X		All wastes would be handled in accordance with all applicable laws.
Water Quality (Surface/Ground)			X	Carried through EA.
Wetlands/Riparian Zones			X	Carried through EA.
Wild and Scenic Rivers	X			
Wilderness/WSA	X			

Table 6: Supplemental Authorities and Rationale for Detailed Analysis for the Proposed Action

Elements[a]	Not Present[b]	Present/Not Affected	Present/May Be Affected[c]	Rationale
[a] See BLM Handbook H-1790-1(2008b) Appendix 1, Supplemental Authorities to be Considered. [b] Supplemental Authorities determined to be Not Present or Present/Not Affected need not be carried forward or discussed further in the document. [c] Supplemental Authorities determined to be Present/May Be Affected must be carried forward in the document. [d] Cultural Resources and Native American resources are discussed in detail in this EA even though no concerns were identified.				

3.1.3 Resources Other Than Supplemental Authorities

The resources or uses identified in Table 7, which are not Supplemental Authorities as defined by BLM's Handbook H-1790-1, are present in the area. BLM specialists have evaluated the potential impact of the Proposed Action on these resources and documented their findings in the table below. Resources or uses that may be affected by the Proposed Action are further described in this EA.

Table 7: Resources Other Than Supplemental Authorities

Elements[a]	Not Present[b]	Present/Not Affected	Present/May Be Affected[c]	Rationale
BLM Sensitive Species (animals)			X	Carried through EA.
BLM Sensitive Species (plants)			X	Carried through EA.
Fire Management/Vegetation			X	Carried through EA.
Forest Resources	X			
General Wildlife			X	Carried through EA.
Lands and Realty			X	Carried through EA.
Lands with Wilderness Characteristics	X			
Livestock Grazing		X		
Minerals			X	Carried through EA.
Paleontological		X		
Recreation		X		
Socioeconomics		X		
Soils			X	Carried through EA.
Travel Management	X			
Vegetation			X	Carried through EA.
Visual Resources			X	Carried through EA.
Wild Horses and Burros	X			
[a] Resources or uses determined to be Present/Not Affected need not be carried forward or discussed further in the document. [b] Resources or uses determined to be Present/May Be Affected must be carried forward in the document.				

3.1.4 Resources or Uses Present and Brought Forward for Analysis (All Supplemental and Resources)

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

- Air Quality
- Floodplains
- Invasive, Nonnative and Noxious Species
- Migratory Birds
- Water Quality
- Wetlands/Riparian Zones
- Visual Resources
- Lands and Realty
- Minerals
- Wildlife/Key Habitat
- BLM Sensitive Species

3.2 AIR QUALITY

3.2.1 Regulatory Environment

The US Environmental Protection Agency Office of Air Quality Planning and Standards and the NDEP have set National Ambient Air Quality Standards and Nevada ambient air quality standards for the following criteria pollutants: nitrogen dioxide, sulfur dioxide, carbon monoxide, particulate matter smaller than 10 microns in aerodynamic diameter, particulate matter smaller than 2.5 microns in aerodynamic diameter, ozone, and lead. In addition to these listed criteria pollutants, NDEP has established an ambient air quality standard for hydrogen sulfide. Nevada Administrative Code 445B.22097 provides the minimum standards of quality for Nevada ambient air.

Attainment is achieved when the existing background concentrations for criteria air pollutants are less than the maximum allowable ambient concentrations defined in the National Ambient Air Quality Standards. Nevada is mandated to identify geographic areas that do not meet federal and state air quality standards. The state uses air quality data gathered by monitoring networks to determine the areas within the state not attaining standards. Areas that violate federal or state standards are referred to as “nonattainment areas” for the relevant pollutants.

3.2.2 Affected Environment

The Proposed Action area is located in a sparsely populated rural area with minimal industrial sources or potential impacts to the airshed. Activities associated with the Proposed Action would occur in Groundwater Basin 128 in Churchill County, Nevada. Groundwater basins in the state of Nevada correspond to airsheds; therefore, Groundwater Basin 128 is the analysis area for air quality. **Figure 5**, Groundwater Basin, shows the Dixie Valley Groundwater Basin, which is the same as Groundwater Basin 128. This basin is in attainment for all National Ambient Air Quality Standards and Nevada air quality standards.

3.2.3 Environmental Consequences

Air emissions from the Proposed Action would be primarily attributable to the following air pollution sources:

- Gravel mining, crushing, and screening
- Heavy equipment and drill rig (diesel exhaust and greenhouse gas emissions)
- Earth moving and grading (particulate fugitive and greenhouse gas emissions)
- Well testing (hydrogen sulfide and greenhouse gas emissions)

3.2.3.1 Gravel Mining, Crushing, and Screening

Fugitive dust emissions during gravel extraction, crushing, screening and transportation to the project site would result in temporary emissions of particulate matter. These emissions would be mitigated through the onsite water spraying for dust control.

3.2.3.2 Heavy Equipment, Drill Rig, and Earth-moving and Grading Activities

Fugitive dust emissions during gravel extraction, construction, and from construction vehicles using the access roads would result in temporary emissions of particulate matter, but these emissions would be of larger particulate sizes and the majority of these fugitive particulate emissions would settle before Dixie Valley. Since the proposed total disturbed area is greater than 5 acres, the NDEP Bureau of Air Pollution Control requires a Surface Area Disturbance Permit and corresponding Dust Control Plan. The NDEP Bureau of Air Pollution Control has jurisdiction of air quality programs over all counties in Nevada except Washoe and Clark counties.

Short-term construction and drill rig exhaust emissions, including volatile organic compounds, carbon monoxide, nitrogen dioxide, particulate matter smaller than 10 microns in aerodynamic diameter, hazardous air pollutants, and oxides of sulfur would result from internal combustion engines and heavy equipment used at the construction site and at the gravel pits. These short-term fugitive emissions would be below the threshold level that would require a permit from NDEP Bureau of Air Pollution Control.

3.2.3.3 Well Testing

Small quantities of naturally occurring non-condensable gases, such as hydrogen sulfide and greenhouse gases (carbon dioxide and much smaller amounts of methane) would be emitted to the air during well testing. Hydrogen sulfide initial concentrations in local geothermal fluids are estimated at approximately 70 parts per million, and methane concentrations are estimated at less than 2 percent of non-condensable gases, based on historical data (Freeman 1986). This estimate is conservative in that more recent tests at the existing Dixie Valley geothermal plant indicate lower concentrations (TGP 2009). As discussed in Chapter 2 of this EA, up to 15 slim wells or exploration wells up to 10,000 feet deep would be drilled and performance tested. Well testing would be conducted for an average of 3 days (24 hours per day) for each well. It is anticipated that the initial flow rates of fluid from each well into its sump (and to the existing Dixie Valley sumps, as required) would be approximately 500 to 1,500 gallons per minute on average (with up

to 700,000 pounds per hour geothermal flow) depending upon the productivity of the well. Based on this estimate, total potential emissions from the proposed well testing would be approximately 26.40 tons hydrogen sulfide (1.76 tons per well).

Air emission sources that exceed 5 tons per year of criteria air pollutant emissions require an air permit from the NDEP Bureau of Air Pollution Control. This permit would be a temporary permit for operations of less than one year duration or a stationary source permit for operations greater than one year duration.

The Proposed Action would require a temporary permit because project-related emissions would be greater than five tons per year, and performance testing would last less than one year. If the total activity duration were extended beyond one year, TGP would obtain a stationary source permit.

3.2.3.4 Heavy Equipment and Well Testing

Cumulative greenhouse gas emissions from well testing and construction-related diesel engines were reviewed and determined to be less than 25,000 tons per year, which is below the level that triggers federal reporting requirements.

Additionally, according to State of Nevada regulations, only electrical generating power plants are required to report greenhouse gas emissions; therefore, the Proposed Actions would not be required to report greenhouse gas emissions.

To minimize air pollution emissions from construction activities and construction and drill rig diesel engines, the following BMPs for fugitive dust and diesel exhaust would be implemented during operational activities:

- Surfacing access roads with aggregate materials, wherever appropriate;
- Using dust abatement techniques, such as watering on unpaved, unvegetated surfaces to minimize airborne dust, as needed. (The source of water to be used for dust abatement is described in Section 2.1.8);
- Posting and enforcing speed limits to reduce fugitive dust (speed limit of 25 miles per hour, as necessary);
- Applying dust abatement techniques (such as watering, requiring loader buckets to be emptied slowly, minimizing drop heights, etc.) to earth-moving, excavating, trenching, and grading activities; and
- Minimizing equipment and vehicle idling times during construction activities.

3.3 FLOODPLAINS

3.3.1 Regulatory Environment

Floodplains are defined by Executive Order 11988, Floodplain Management, as “the lowland and relatively flat areas adjoining inland and coastal waters including flood-prone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year” (i.e., area inundated by a 100-year flood). Executive Order 11988 directs

federal agencies to take actions to reduce the risk of flood loss, minimize flood impacts on human safety, health and welfare, and restore and preserve floodplain natural and beneficial values. To do this, the order bans approving activities in a floodplain unless no practicable alternative exists, and measures to minimize unavoidable short-term and long–term impacts are included.

3.3.2 Affected Environment

Federal Emergency Management Agency flood maps indicate that a southern portion of the Project Area is a designated 100-year floodplain. A portion of this floodplain is also identified as a "lake" by the US Fish and Wildlife Service (USFWS)-administered National Wetland Inventory. These designations are shown in **Figure 6**, Water Features, and are part of the Humboldt Salt Marsh.

3.3.1 Environmental Consequences

All project features have been designed to comply with the lease stipulation requiring no surface occupancy or surface disturbance within 650 feet of any floodplain. There would be no effect on floodplains.

3.4 WATER RESOURCES

3.4.1 Affected Environment

3.4.1.1 Groundwater

The Lease Area is located in the internally drained Dixie Valley groundwater basin (Nevada Division of Water Resources-designated Administration Groundwater Basin 128). Dixie Valley is located in Nevada Hydrographic Region 10 (Central Region) (NDCNR-DWR 2005), and is in the Great Basin hydrographic area. By Order 715, dated June 8, 1978, the Nevada State Engineer has designated the Dixie Valley groundwater basin, which indicates that the permitted groundwater rights approach or exceed the estimated average annual recharge and the water resources are being depleted or require additional administration (NDCNR-DWR 2009).

Groundwater Basin 128 has an area of 1,303 square miles and a perennial yield of 15,000 acre-feet per year. The basin has committed underground water rights of 18,076 acre-feet per year and geothermal water rights of 13,428 acre-feet per year (NDCNR-DWR 2009). Groundwater occurs in alluvial basin fill sediments and in underlying bedrock. In the northern portion of Dixie Valley where the Project Area is located, groundwater moves south through the valley, east from the Stillwater Mountains, and west from the Clan Alpine Mountains.

Recharge to groundwater occurs from precipitation, primarily snowmelt, at higher elevations in the Stillwater Range and Clan Alpine Range west and east of Dixie Valley and in the alluvial fans and landslide deposits at the base of these mountains. The Humboldt Salt Marsh (playa) is the ultimate groundwater sink for Dixie Valley and six subbasins that are adjacent to Dixie Valley (Fairview, Pleasant, Jersey, Eastgate, Cowkick, and Stingaree valleys). Groundwater moves radially from the surrounding mountains and converges on the playa, where it discharges to the surface. Vertically, groundwater moves upward in the central part of the valley in response

to hydraulic gradients, where it discharges to the playa and is lost to evaporation and transpiration.

Groundwater occurs in two separate but related aquifers in Dixie Valley: a shallow, non-thermal, alluvial aquifer and a deep, thermal, bedrock aquifer (Karst 1987).

Groundwater in the alluvium occurs under unconfined and confined conditions; however, hydraulic heads are typically beneath the elevation of the valley floor. Thermal groundwater is confined and generally occurs in fractured, zones within the bedrock underlying the alluvial basin fill sediments. Deep thermal groundwater and shallower alluvial groundwater are separated by a confining sequence thousands of feet thick, composed of shale, siltstone, volcaniclastic rocks, and a complex of intrusive and extrusive igneous rocks that includes gabbro, diorite, and basalt (Bruton et al. 1997). Fumaroles, hot springs, and warm springs along the west edge of Dixie Valley near the base of the Stillwater Range are believed to originate from deep geothermal water moving up a zone of locally enhanced permeability caused by the Dixie Meadows fault system (Smith et al. 2001). Chloride isotope analysis and a geochemical mixing evaluation reported by Bruton et al. (1997) indicates that shallow groundwater in Dixie Valley contains approximately 15 percent geothermal water, likely from fumaroles and hot springs in the area. As a groundwater discharge area, the depth to groundwater is anticipated to be shallow throughout much of northern Dixie Valley and would be expected to be shallowest close to the Humboldt Salt Marsh.

The total dissolved solids concentration in shallow alluvial groundwater in Dixie Valley ranges from 900 to 1,900 milligrams per liter according to data tabulated by Karst (1987). Thermal groundwater in the area generally has higher dissolved solids content; however, the maximum total dissolved solids value reported by Karst was 1,920 milligrams per liter, essentially the same as the maximum non-thermal groundwater concentration of 1,900 milligrams per liter (Karst 1987).

3.4.1.2 Surface Water

Based on analysis of US Geological Survey (USGS) topographic maps and Nevada Division of Water Resources groundwater basin mapping (Figure 5, Groundwater Basin), the Proposed Action would be located in an internally drained desert basin that is a great distance from and lacks hydrographic connectivity to major rivers and water bodies. Therefore, there are no navigable waters of the United States within Rivers and Harbors Act jurisdiction (as defined by 33 CFR part 329) and no waters of the United States within Clean Water Act jurisdiction (as defined by 33 CFR 328) in the Project Area.

The USGS 7.5-minute topographic map of the area (Bolivia, Nevada Quadrangle 1990) shows ephemeral washes flowing southeast across the alluvial fan and valley bottom within the Lease Area and into the Humboldt Salt Marsh within Dixie Valley (see Figure 6, Water Features). The southeastern portion of the Lease Area is within the Humboldt Salt Marsh. The ephemeral washes only flow from significant rainfall or snowmelt events and those observed during field visits were dry. Federal Emergency Management Agency Flood Insurance Rate Maps show the presence of a flood hazard zone within the southern portion of the Lease Area. Floodplains are discussed in **Section 3.3**, Floodplains. USGS mapping shows four seeps and springs in Section

27 and a grouping of spring-fed wetlands on the western edge of the Lease Area in Section 36 (see Figure 6, Water Features).

3.4.2 Environmental Consequences

As discussed in **Section 3.9**, Vegetation, palustrine emergent wetlands associated with springs and seeps are present within the Lease Area in Section 27 (see Figure 6, Water Features). Based on a review of USGS topographic maps and Nevada Division of Water Resources groundwater basin mapping, these water bodies are not jurisdictional waters of the U.S. because they are located in an internally drained desert basin that is distant from and lacks hydrographic connectivity to major rivers and water bodies. Although the waters are not jurisdictional waters of the United States, construction activities would avoid wetland areas associated with seeps and springs to the extent possible.

As described in Chapter 2, access roads would be constructed as part of the Proposed Action. Roads and wells would be located and designed to avoid impacts to surface water features such as springs, seeps, and ephemeral washes to the extent possible.

Well testing would involve removing thermal groundwater and discharging it to the drill pad sump. Excess fluids from each well would be trucked to existing sumps at the Dixie Valley geothermal power plant. The anticipated test flow rates (500 to 1,500 gallons per minute) and durations (average of 3 days) may result in 2 to 6 million gallons of thermal groundwater being extracted from the geothermal aquifer for each well during testing. Installation and testing of deep geothermal wells has the potential to cause impacts on surface water through accidental release of geothermal fluids to surface water features. To prevent a release of geothermal fluids to surface water features, drilling muds and geothermal fluids would be contained in the sump or trucked to the existing sumps at the Dixie Valley geothermal power plant when quantities dictate.BMPs for well installation and testing would be implemented as described below.

The release of hazardous materials to the environment could affect surface water features. Because ephemeral washes exist in the proposed Project Area, impacts on surface hydrology may occur.

Possible releases of materials utilized during construction activities, primarily hydrocarbon releases from construction equipment, potentially could impact stormwater. A Stormwater Pollution Prevention Plan and a Spill Prevention, Control, and Countermeasures Plan would be developed to prevent release of hazardous materials to the environment. TGP would provide a Notice of Intent to the NDEP prior to well pad construction.

In addition to these measures, the following steps would be undertaken during construction to avoid or minimize the potential for impacts to surface water or groundwater in the area:

- 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.
- Drill pad sumps would be compacted during construction and settled bentonite clay from drilling mud would accumulate on the bottom of the drill pad sump to act as an

unconsolidated clay liner, reducing the potential for drilling fluid to percolate to groundwater.

- TGP would obtain necessary working in waters and/or groundwater discharge permits and provide a Notice of Intent to NDEP prior to well pad construction.
- Wetland boundaries would be avoided to the extent possible.
- A BLM-approved grouting and casing program for construction of slim well or exploration 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 and therefore minimizing potential impacts on surface washes, springs, seeps, or floodplains.
- BMPs would be implemented to ensure that any geothermal fluid encountered during the drilling does not flow uncontrolled to the surface. These include the use of blowout prevention equipment during drilling and the installation of well casing cemented into the ground.
- A Hydrologic Monitoring Plan will be submitted to the BLM for approval prior to drilling.

3.4.2.1 Hydrologic Monitoring Plan

Standard aquifer testing procedures would be employed at targeted depth intervals as the boreholes for slim wells or exploration wells are advanced. The vertical boundaries of the aquifers, the depth of aquifers (non-thermal and thermal) penetrated during drilling, would be noted from the drilling log. The horizontal boundaries would be noted if any are reflected on time-drawdown plots produced during aquifer testing. Borehole geophysics analysis would be conducted from the ground surface to the total depth of the borehole. Aquifer testing would be used to determine drawdown associated with pumping. If possible, an assessment of whether the aquifer is confined or unconfined would be made, as well as an estimate of aquifer thickness and a qualitative assessment of its relative productivity. The temperature of penetrated aquifers would be noted. A Hydrologic Monitoring Plan would be put in place to confirm the expectation that no impacts to quality, quantity, or temperature of groundwater occurred as a result of slim well or exploration well installation and testing.

3.5 SOILS

3.5.1 Affected Environment

Soil types in the project area were identified using the Churchill County Area, Parts of Churchill and Lyon Counties soil survey (USDA NRCS 2009). Descriptions of the three soil types found in the Project Area are provided in this section. Soil types related to the playa and the Stillwater Range are not discussed since no activities are proposed for these areas; however, the location of these soil types are shown on **Figure 7**, Soils.

3.5.1.1 Slaw-Trocken-Chuckles association

Slaw soils occur on 0 to 4 percent slopes, are well drained, occasionally flood but never pond, and are moderately to strongly saline. The typical profile is composed of silt loam underlain by stratified very fine sandy loam to silty clay. Trocken soils occur on 0 to 2 percent slopes, are well drained, occasionally flood but never pond, and are moderately to strongly saline. The typical profile includes very gravelly loam and gravelly loamy coarse sand. Chuckles soils occur on 0 to 2 percent slopes, are moderately well drained, never flood or pond, and are moderately to strongly saline. The typical profile is composed of loam and silt loam underlain by stratified very fine sandy loam to silty clay. This soil unit has a slight hazard of off-road or off-trail erosion and is poorly to moderately suited for natural surface road construction primarily due to flooding potential and low strength (USDA NRCS 2009).

3.5.1.2 Settlement-Louderback-Rustigate association

Settlement soils occur on 0 to 2 percent slopes, are poorly drained, have a water table depth of 12 to 36 inches, rarely flood and never pond, and are slightly to moderately saline. The typical soil profile consists of silty clay and clay. Louderback soils occur on 0 to 2 percent slopes, are somewhat poorly drained, have a water table at 36 to 40 inches, rarely flood and never pond, are very slightly or slightly saline, and support saline meadow vegetation. The typical soil profile is composed of sand underlain by stratified sand to loam. Rustigate soils occur on 0 to 2 percent slopes, are somewhat poorly drained, have a water table at 36 to 40 inches, rarely flood and never pond, and support a saline meadow vegetation community. The profile is typically silt loam underlain by loam. This soil unit has a slight hazard of off-road or off-trail erosion and is moderately suited for natural surface road construction, primarily due to low strength and sandiness (USDA NRCS 2009).

3.5.1.3 Bluewing-Pineval association

Bluewing soils occur on 4 to 8 percent sloping fans or washes, are excessively drained, and flood rarely to occasionally but never pond. The soil profile typically consists of very gravelly loamy sand underlain by stratified very gravelly sand to extremely loamy coarse sand. Pineval soils occur on 4 to 8 percent slopes, are well drained, and rarely flood and never pond. The typical soil profileincludes very cobbly loam and very gravelly sandy clay loam underlain by stratified extremely gravelly sand to gravelly sandy loam. This soil unit has a slight hazard of off-road or off-trail erosion and is moderately suited for natural surface road construction, due to flooding potential, sandiness, and slope (USDA NRCS 2009).

3.5.2 Environmental Consequences

The hazard of off-road or off-trail soil erosion in the Project Area is slight (USDA NRCS 2009). The soils are poorly to moderately suited for natural surface road construction (USDA NRCS 2009); therefore, TGP would implement the BMPs described below when constructing access roads and well pads.

The loss of soil productivity is expected to be low because the soils have low native fertility and no farmlands, as covered under the Farmland Protection Policy Act (Public Law 97-98, 7 USC 4201), are present within the Lease Area.

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 Countermeasures Plan, are described in Section 3.4.2.

Erosion and loss of soil productivity would be minimized by implementing the following BMPs during access road and well pad construction:

- Excavation into native soil during construction of well pad sumps would be minimized to the maximum extent possible.
- Wells and roads not required for development purposes would be re-contoured to blend with the surrounding topography, in accordance with lease stipulations.
- 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 immediately after completion of construction activities to avoid erosion and runoff.
- Access roads would follow existing contours to the maximum extent possible. In areas where new access roads must be constructed across slopes, erosion control measures 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, a gravel surface would be installed prior to additional use.
- When construction occurs in areas of very soft soils, up to 3 feet of aggregate would be used.
- An NDEP Bureau of Air Pollution Control Surface Area Disturbance documenting the BMPs to be used would be required for the project because the surface disturbed would be greater than 5 acres.

3.6 VISUAL RESOURCES

3.6.1 Affected Environment

BLM utilizes a visual resource management (VRM) process to manage the quality of landscapes on public land and to evaluate the potential impacts to visual resources resulting from development activities. VRM 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).

Based on information contained in the Consolidated RMP (BLM 2001) and environmental assessments for other projects sharing this vicinity, the Lease Area is located within a Class IV VRM 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 closest transportation route is Dixie Valley Road, which is designated State Route 121. The closest urban sensitive receptor (park, church, residence, school, or hospital) is located in Lovelock, Nevada, approximately 27 air miles west of the project sites. The Stillwater Mountain Range, with peaks higher than 8,500 feet, is located south and west of the Lease Area. The closest receptor would be the 7 Devils Ranch located approximately 18 miles northeast of the Lease Area.

3.6.2 Environmental Consequences

Temporary impacts to visual resources would occur during road and well pad construction activities at the Project Area and as a result of the presence of drill rigs. Drilling equipment would be seen from Dixie Valley Road. Roads, drill pads, and laydown areas are near ground level and would not affect visual resources. Construction impacts would be minor and short-term and would be consistent with the objectives of Class IV VRM objective.

During the drilling operations, the drill rig could extend up to about 160 feet above ground level. These operations would be 24 hours per day, 7 days per week. During drilling operations, the rig would be visible at distances of greater than 1 mile from the respective drill sites, and lights used when drilling at night would increase rig visibility. All drill rig and well test facility lights would be limited to those required to safely conduct the operations and would be shielded or directed in a manner that focuses direct light to the immediate work area.

Access roads would remain after the wells have been drilled until reclamation is conducted as described in Section 2.1.10. Laydown areas and concrete slab drill pads would be removed as described in Section 2.1.10 if they are no longer needed.

The Stillwater Mountain Range, with peaks higher than 8,500 feet, is between the Lease Area and Lovelock. The Project Area is, therefore, not visible from the Lovelock area. The Project Area is located approximately 18 miles away from the 7 Devils Ranch and are therefore not likely to be visible from the ranch.

3.7 LANDS AND REALTY

3.7.1 Affected Environment

Most of the land in Dixie Valley is federal land managed by the BLM and nearly all of it is designated as having the highest geothermal resource potential of any BLM-managed public lands in the state (BLM 2001). The federal government administers more than 82 percent of the

land in Churchill County. In accordance with the BLM PEIS for Geothermal Development (BLM 2008a) and the Churchill County Master Plan (2010), the expansion and development of geothermal resources is supported and promoted for federal lands in this region in support of a national energy policy for renewables. A BLM designated utility corridor exists within Dixie Valley with the express purpose of providing an outlet for geothermal power to be produced in the valley (BLM 2001). There is a transmission line within this corridor.

Small private parcels exist throughout the valley, and a large portion of the southern half of the valley is controlled by the Department of Defense for testing of low-level supersonic flight operations as part of the Fallon Range Training Complex.

The existing Terra-Gen Dixie Valley geothermal plant is just north of the Lease Area, and a small private ranch is approximately 12 miles northeast of the Dixie Valley geothermal plant. The area is relatively undeveloped and most of the valley is utilized for cattle grazing, with BLM assuming grazing management responsibility on adjacent military-controlled lands.

Several ROWs or other authorizations have been granted on public lands within the Project Area. These include ROWs for transmission lines, roads, and geothermal leases. All BLM-registered geothermal leases in the area are held by TGP.

BLM also has prepared a PEIS for Geothermal Leasing in the Western US (BLM 2008a), which analyzes potential impacts of geothermal development and provides a list of stipulations and BMPs related to geothermal leasing and related development on BLM-managed public land. In 2008, BLM issued a Record of Decision for geothermal leasing in the Western US, including adoption of RMP amendments related to geothermal leasing (BLM 2008d).

3.7.2 Environmental Consequences

Existing linear ROWs in the vicinity of the Lease Area include the Terra-Gen Dixie Valley 230-kilovolt transmission line and its associated access road and State Route 121 to the south, which would be used only for access to the Project Area. The Proposed Action does not include drilling or other exploration activities in the State Route 121 ROW. The use of the lands for geothermal development would not preempt the other current uses of the land identified in Section 3.7.1.

The Department of Defense operates the Fallon Range Training Complex, a portion of a military operating area designated for low-level supersonic flight operations over the Dixie Valley region. Impacts to the military operating area are reviewed by the Federal Aviation Administration if the Federal Aviation Administration obstruction thresholds are triggered. The Proposed Action would not trigger the Federal Aviation Administration obstruction thresholds (14 CFR Part 77.13) because it would not include:

- Construction or alteration exceeding 200 feet above ground level;
- Construction or alteration:
  - within 20,000 feet of a public use or military airport which exceeds a 100 to 1 (horizontal to vertical) surface from any point on the runway of each airport with at least one runway more than 3,200 feet,

- within 10,000 feet of a public use or military airport which exceeds a 50:1 surface from any point on the runway of each airport with its longest runway no more than 3,200 feet
- within 5,000 feet of a public use heliport which exceeds a 25:1 surface;

- Highway, railroad, or other traverse way whose prescribed adjusted height would exceed the above noted standards; or
- Construction or alteration located on a public use airport or heliport regardless of height or location.

3.8 MINERALS

3.8.1 Affected Environment

Precious metals have historically been mined in the Clan Alpine Mountains bordering Dixie Valley. Existing mines in Churchill County are located around its periphery, far from Dixie Valley, which is situated in the central part of the county. Based on a review of the online Mineralogy Databases (Mindat.org 2012), Cottonwood Canyon is the only identified mine within Dixie Valley, located approximately 4 miles north of the Lease Area. The mine is reported as being a producer of opal. There are no major mines currently operating in Dixie Valley (Nevada Bureau of Mines and Geology 2011). There are currently 100 active unpatented lode mining claims within Township T24N, Range R36E. There is a material community pit near the Proposed Action area in Township 24N, Range 36E, Section 16, approximately 1.5 miles north of the Lease Area.

3.8.2 Environmental Consequences

The Proposed Action would result in the extraction of gravel from up to three gravel pits in Dixie Valley. Gravel is an abundant resources in the area and the Proposed Action would not impact the availability of gravel for other users. The Proposed Action does not involve any other mineral extraction and would not affect current or anticipated future mineral exploration, extraction, or processing activities beyond the physical impediment presented by project infrastructure (roads, pipelines, drill pads, and appurtenant features).

3.9 VEGETATION

A field survey of the Project Area was conducted in May 2011. The geographic information systems landcover data from the Southwest Regional GAP Analysis Project (SWReGAP) (USGS National Gap Analysis Program 2004) were used as a basis for field verification of vegetation communities.

3.9.1 Affected Environment

In general, the vegetation within the Project Area is fairly homogenous, composed of mainly salt desert shrub, greasewood flat, or playa. Biotic crusts occur in many locations, indicating a lack of prior soil disturbance. However, invasive species such as cheatgrass (*Bromus tectorum*) and halogeton (*Halogeton glomeratus*) occur throughout the Project Area, and cheatgrass is the dominant species in some areas. **Table 8**, SWReGAP Landcover Types within the Project Area,

presents the SWReGAP landcover types, landcover description, and associated acreages within the Project Area.

Table 8: SWReGAP Landcover Types within the Project Area

SWReGAP Landcover Type	Landcover Description	Approximate Acres
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.	2,130 (~44 acres of which is within gravel pit areas)
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.	1,147
Inter-Mountain Basins Greasewood Flat	Typically occurs near drainages on stream terraces and flats or may form rings around more sparsely vegetated playas; typically have saline soils, a shallow water table and flood intermittently, but remain dry for most growing seasons; usually occurs as a mosaic of multiple communities, with open to moderately dense shrublands dominated or co-dominated by greasewood (*Sarcobatus* spp.); often surrounded by mixed salt desert scrub.	283 (~1 acre of which is within a gravel pit area)
North American Arid West Emergent Marsh	Frequently or continually inundated, with water depths up to 2 meters. Water levels may be stable or may fluctuate 1 meter or more over the course of the growing season. Vegetation is characterized by herbaceous plants that are adapted to saturate soil conditions, such as rushes (*Juncus* spp.) and cattails (*Typha* spp.)	16
Inter-Mountain Basins Cliff and Canyon	Found from foothill to subalpine elevations and includes barren and sparsely vegetated landscapes (generally <10% plant cover) of steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous, sedimentary, and metamorphic bedrock types. Also included are unstable scree and talus slopes that typically occur below cliff faces. Widely scattered trees and shrubs may include *Abies concolor, Pinus edulis, Pinus flexilis, Pinus monophylla, Juniperus* spp., *Artemisia tridentata, Purshia tridentata, Cercocarpus ledifolius,*	0.5 (gravel pit area only)

Table 8: SWReGAP Landcover Types within the Project Area

SWReGAP Landcover Type	Landcover Description	Approximate Acres
	Ephedra spp., *Holodiscus discolor*, and other species often common in adjacent plant communities.	
Source: USGS National Gap Analysis Program 2005		

3.9.2 Environmental Consequences

Impacts to vegetation would be minimized by reseeding all areas of access roads and well pads not required for subsequent energy production using a BLM-approved native seed mixture. Topsoil would be salvaged whenever possible and reused in a timely manner.

Withdrawal of groundwater for flow testing has the potential to affect hydrophytic marsh vegetation that is supported by hot springs in the vicinity of the Project Area by lowering the water table. As described in Section 3.4, Water Resources, a Hydrologic Monitoring Plan would be put in place to confirm the expectation that no impacts to quality, quantity, or temperature of surface water and groundwater occurred as a result of slim well or exploration well installation and testing. Disturbance to marsh vegetation would be avoided to the extent possible.

3.10 INVASIVE, NONNATIVE, AND NOXIOUS WEED SPECIES

3.10.1 Regulatory Environment

3.10.1.1 Federal Noxious Weed Act of 1974

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

3.10.1.2 Executive Order 13112, Invasive Species

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

3.10.2 Affected Environment

The State of Nevada lists 47 noxious weed species that require control (Nevada Administrative Code 555.10). Of these, tamarisk was observed in several areas within the Project Area. Tamarisk within the Project Area has been treated with pesticides by the BLM to eradicate this

invasive species. Cheatgrass and halogeton are invasive species that were observed throughout the Project Area. In particular, small cheatgrass-dominated patches were noted in certain areas.

3.10.3 Environmental Consequences

The Proposed Action has the potential to increase the spread of invasive, nonnative species. Weed seeds can germinate when soils are disturbed by construction activities, particularly where available soil moisture is increased by application of water for dust suppression. Weeds also could be introduced by construction equipment brought to the project from infested areas or by the use of seed mixtures or mulching materials containing weed seeds.

The potential for the Proposed Action to increase the spread of invasive, non-native species would be minimized through the use of BMPs as described in Section 2.1.10.

3.11 MIGRATORY BIRDS

Surveys were completed as described in **Section 3.9**, Vegetation. Migratory birds were noted when seen.

Raptors were surveyed specifically for the presence of nests by examining all rocky outcrops for suitability (e.g., enough vertical exposure), whitewash, and stick nests. Special status species raptors, including golden eagles, are discussed in **Section 3.14**, Special Status Species.

3.11.1 Regulatory Environment

3.11.1.1 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.

3.11.1.2 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 USFWS that promotes the conservation of migratory bird populations.

3.11.1.3 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.

3.11.2 Affected Environment

Based on the habitats observed, numerous migratory bird species have the potential to occur within the Project Area. Eighteen species were observed during field surveys, including black-throated sparrow (*Amphispiza bilineata*), loggerhead shrike (*Lanius ludovicianus*), northern harrier (*Circus cyaneus*), and western kingbird (*Tyrannus verticalis*).

3.11.2.1 Birds of Conservation Concern

Birds of Conservation Concern that could potentially occur within the Project Area are presented in **Table 9**, Birds of Conservation Concern Potentially Occurring within the Project Area. The following Birds of Conservation Concern are considered unlikely to occur based on lack of suitable habitat within the Project Area: tricolored blackbird (*Agelaius tricolor*), American bittern (*Botaurus lentiginosus*), yellow-billed cuckoo (*Coccyzus americanus*), peregrine falcon (*Falco peregrinus*), olive-sided flycatcher (*Contopus cooperi*), northern goshawk (*Accipiter gentilis*), rufous hummingbird (*Selasphorus rufus*), pinyon jay (*Gymnorhinus cyanocephalus*), pygmy nuthatch (*Sitta pygmaea*), flammulated owl (*Otus flammeolus*), spotted owl (*Strix occidentalis*), greater sage-grouse (*Centrocercus urophasianus*), red-naped sapsucker (*Sphyrapicus nuchalis*), Williamson's sapsucker (*Sphyrapicus thyroideus*), black swift (*Cypseloides niger*), black-throated gray warbler (*Dendroica nigrescens*), Virginia's warbler (*Vermivora virginiae*), willet (*Tringa semipalmata*), Lewis's woodpecker (*Melanerpes lewis*), and white-headed woodpecker (*Picoides albolarvatus*).

Table 9: Birds of Conservation Concern Potentially Occurring within the Project Area

Species	Habitat	Potential for Occurrence
American avocet *Recurvirostra americana*	Shallow marsh with sparse emergent vegetation; large mudflats; dry islands; playa margins	Potential to occur.
Long-billed curlew *Numenius americanus*	Grasslands and irrigated agricultural fields	Potential to occur.
Golden eagle *Aquila chrysaetos*	Variety of open and semi-open landscapes with sufficient mammalian prey base and cliff sites for nesting	Confirmed (see Section 3.14.2).
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. Ample cliffs for nesting and shrublands for foraging. Observed during 2009 surveys.
Northern harrier *Circus cyaneus*	Marshes, meadows, grasslands, and cultivated fields; nests on ground, usually	Confirmed. Observed within Project Area during surveys.

Table 9: Birds of Conservation Concern Potentially Occurring within the Project Area

Species	Habitat	Potential for Occurrence
	in dense cover	
Swainson's hawk *Buteo swainsoni*	Usually occurs close to riparian or other wet habitats; forages over agricultural fields, wet meadows, or open shrublands	Confirmed. Observed within Project Area during surveys.
Ferruginous hawk *Buteo regalis*	Grasslands and semi-desert shrublands; nest in isolated trees, on rock outcrops, or ground	Potential to occur.
Costa's hummingbird *Calypte costae*	Desert, shrubland, chaparral	Potential to occur.
Burrowing owl *Athene cunicularia*	Treeless areas with low vegetation and burrows	Potential to occur.
Short-eared owl *Asio flammeus*	Wet meadow or grassland bordered by open shrublands or other dry habitat	Potential to occur.
Wilson's phalarope *Phalaropus tricolor*	Variety of large and small marshes with sufficient shoreline vegetation; ephemeral wetlands and playas for migration	Potential to occur.
Snowy plover *Charadrius alexandrinus*	Alkali flat, mudflat, or flat beach adjacent to permanent or seasonal surface water	Potential to occur.
Loggerhead shrike *Lanius ludovicianus*	Open country with scattered trees and shrubs, desert scrub; nests in shrubs or small trees	Confirmed. Observed within Project Area during surveys.
Brewer's sparrow *Spizella breweri*	Sagebrush, greasewood, perennial upland grasslands	Potential to occur.
Sage sparrow *Amphispiza belli*	Treeless sagebrush or salt desert shrubland with little or no cheatgrass invasion	Potential to occur.
Gray vireo *Vireo vicinior*	Hot, semi-arid, shrubby habitats	Potential to occur.
Sources: GBBO 2010; NatureServe 2011; Wildlife Action Plan Team 2006		

3.11.2.2 Game Birds Below Desired Condition

The two species of game birds below desired condition that could occur within the Project Area are the mallard and mourning dove. Many mourning doves were observed during the field survey, although no mallards were observed. Game birds below desired condition considered unlikely to occur based on lack of suitable habitat include canvasback (*Aythya valisineria*), ring-necked duck (*Aythya collaris*), wood duck (*Aix sponsa*), band-tailed pigeon (*Columba fasciata*), and northern pintail (*Anas acuta*).

3.11.3 Environmental Consequences

Direct impacts stem from approximately 113 acres of actual habitat that would be disturbed in the Lease Area plus the three gravel pits during the life of the Proposed Action, although effective habitat loss from the disturbance and fragmentation may encompass a larger area for some species. Construction, human activity, and increased noise in the area from construction and drilling could temporarily displace migratory birds from the area. However, large tracts of similar habitat are found adjacent to the Project Area, and migratory birds would likely return to the area after construction.

The Migratory Bird Treaty Act analyzes requirements related to ground-disturbing activities during the migratory bird nesting season. To meet these requirements, habitat for migratory birds would be eliminated within areas of proposed disturbance prior to the nesting season. In the event this elimination measure is not implemented, if ground-disturbing activities do take place during the migratory bird nesting season, migratory bird nest surveys would be conducted early in the nesting season by a qualified biologist acceptable to 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 these areas to be disturbed, TGP would coordinate with BLM to develop appropriate protection measures for these sites, which may include avoidance, construction constraints, and/or the establishment of buffers.

To minimize impacts to migratory birds and other wildlife, in addition to the management practices described above, well pads and roads would be recontoured and reseeded following completion of the Proposed Action as described in Section 2.1.9. Erosion-control measures would be implemented as described in Section 3.5.2. Topsoil would be salvaged and reused whenever possible and in a timely manner.

3.12 WETLANDS/RIPARIAN ZONES

3.12.1 Regulatory Environment

3.12.1.1 Executive Order 11990, Protection of Wetlands

Executive Order 11990 directs federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial value of wetlands in carrying out programs affecting land use.

3.12.1.2 Executive Order 11988, Floodplain Management, as amended by Executive Order 12148

This Executive Order directs each federal agency to take action to avoid the long- and short-term adverse impacts associated with the occupancy and modification of floodplains. Agencies are further required to avoid direct or indirect support of floodplain development whenever there is a practicable alternative.

3.12.2 Affected Environment

There are no riparian zones within the Project Area. However, there are two seasonally wet habitat types that occur in the Project Area: Inter-Mountain Basins Playa and North American Arid West Emergent Marsh.

3.12.2.1 Inter-Mountain Basins Playa

The playa community comprises the eastern portion of the Project Area. It is largely unvegetated, with some salt grass (*Distichlis spicata*) growing and salt crusts visible.

3.12.2.2 North American Arid West Emergent Marsh

One area in the southwestern portion of the Project Area is characterized as North American Arid West Emergent Marsh. Within the Project Area, this community is more accurately described as a wet meadow with a small marsh component, as it has a high percent cover of salt grass and small patches of Baltic rush (*Juncus balticus*) and canary reedgrass (*Phragmites australis*). The source of water for the wet meadow is located just west of the Project Area boundary, where there is a spring.

3.12.3 Environmental Consequences

As described in Chapter 2, access roads would be constructed as part of the Proposed Action. Roads and wells would be located and designed to avoid impacts to surface water features such as springs, seeps, ponds, and ephemeral washes to the extent possible.

The release of hazardous materials to the environment could affect wetlands. BMPs to prevent such a release, including development of a construction Stormwater Pollution Prevention Plan and a Spill Prevention, Control, and Countermeasures Plan, are described in Section 3.4.2. Similarly, erosion could affect surface water quality. Erosion-control measures would be implemented as described in Section 3.5.2. In addition to these measures, measures listed in Section 3.4.2 would avoid or minimize the potential for impacts on wetlands in the area.

3.13 WILDLIFE/KEY HABITAT

Surveys were completed as described in **Section 3.9**, Vegetation. Wildlife were noted when seen, and the SWReGAP was used to field verify the vegetation types within the Project Area.

3.13.1 Affected Environment

Table 10, Typical Wildlife Species Associated with Habitats within Project Area, presents the habitat types within the Project Area and typically associated wildlife species within the Great Basin. Species documented during surveys were characteristic of the habitat types found within the Project Area. Acreages of habitat types are presented in **Section 3.9**, Vegetation.

Table 10: Typical Wildlife Species Associated with Habitats within Project Area

Habitat Type[1]	Associated Species
Inter-Mountain Basins Mixed	Pronghorn antelope; coyote; pocket mouse; loggerhead shrike;

Table 10: Typical Wildlife Species Associated with Habitats within Project Area

Salt Desert Scrub	common raven; side-blotched lizard
Inter-Mountain Basins Playa	Pocket gopher; killdeer; American avocet; black-necked stilt
Inter-Mountain Basins Greasewood Flat	Black-tailed jackrabbit; white-tailed antelope squirrel; black-throated sparrow; horned lark; desert horned lizard
North American Arid West Emergent Marsh	Yellow-headed blackbird; marsh wren; spotted sandpiper; bullfrog
[1] Based on SWReGAP landcover types	

3.13.2 Environmental Consequences

Direct impacts to wildlife species stem from disturbance of approximately 113 acres of actual habitat, although effective habitat loss from disturbance and fragmentation may encompass a larger area for some species.

Construction of access roads, installation of wells and extraction of gravel would result in direct loss of habitat. Direct impacts from mortality to smaller, less mobile species could occur during construction and gravel extraction if those species are present. Noise, human presence, and heavy equipment present during construction activities are likely to temporarily displace wildlife that may be present or near the Project Area and could have an indirect effect on wildlife species in the area. These indirect effects could reduce breeding success of species that are sensitive to human activity. These impacts are expected to be temporary and short term for the duration of the proposed construction and drilling activities. Wildlife would be able to return to the disturbed areas upon completion of ground-disturbing activities. No population-level impacts to wildlife species are expected as a result of implementation of the Proposed Action. Because wildlife would likely return to the area after construction is complete and because similar habitat is available near the Project Area, impacts to wildlife are expected to be minor from implementation of the Proposed Action.

3.14 SPECIAL STATUS SPECIES

Surveys were completed as described in **Section 3.9**, Vegetation. Special status species were noted when seen, but species-specific surveys were not conducted.

In addition, an aerial golden eagle survey was conducted for two nearby projects which encompassed a four-mile buffer around the Project Area. Active and inactive nests were mapped using GPS technology.

3.14.1 Regulatory Environment

3.14.1.1 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 ESA 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]).

3.14.1.2 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.

3.14.1.3 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, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding or sheltering behavior."

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.

BLM requires consideration and NEPA analysis of golden eagles and their habitat for all renewable energy projects (BLM Instruction Memorandum No. 2010-156). The BLM Instruction Memorandum 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 identifying steps that may be necessary within the habitat of golden eagles to ensure

environmentally responsible authorization and development of renewable energy resources. The Instruction Memorandum primarily addresses golden eagles because a process to acquire take permits for bald eagles already exists. The Instruction Memorandum is applicable until the USFWS establishes criteria for programmatic golden eagle permits.

3.14.2 Affected Environment

3.14.2.1 Threatened or Endangered Species

No federally listed endangered or threatened species have the potential to 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. The USFWS noted that a candidate for ESA listing, greater sage-grouse, could occur in the Project Area (USFWS 2011), although this is unlikely given the lack of sagebrush habitat.

3.14.2.2 BLM Sensitive Species

BLM Sensitive species with the potential to occur within the Project Area are presented in **Table 11**, BLM Sensitive Species Potentially Occurring within the Project Area. The NNHP does not have any recorded special status species within a five kilometer radius around the Project Area (NNHP 2011). In addition, the following BLM sensitive species are considered unlikely to occur based on lack of suitable habitat: northern leopard frog (*Rana pipiens*), northern goshawk, peregrine falcon, long-eared owl (*Asio otus*), flammulated owl, Lewis's woodpecker, red-naped sapsucker, juniper titmouse (*Baeolophus griseus*), pinyon jay, black rosy finch (*Leucosticte atrata*), mountain quail (*Oreortyx pictus*), greater sage-grouse, sandhill crane (*Grus canadensis*), black tern (*Chlidonias niger*), least bittern (*Ixobrychus exilis*), California wolverine (*Gulo gulo*), river otter (*Lontra canadensis*), western white-tailed jackrabbit (*Lepus townsendii*), pygmy rabbit (*Brachylagus idahoensis*), California floater (*Anodonta californiensis*), Hardy's aegialian scarab (*Aegialia hardyi*), Sand Mountain aphodius scarab (*Aphodius* sp.), Sand Mountain serican scarab (*Serica psammobunus*), Sand Mountain blue (*Euphilotes pallescens arena montana*), wind-loving buckwheat (*Eriogonum anemophilum*), and oryctes (*Oryctes nevadensis*).

Table 11: BLM Sensitive Species Potentially Occurring within the Project Area

Species	Habitat	Potential for Occurrence
Plants		
Nevada dune beardtongue *Penstemon arenarius*	Deep, volcanic, sandy soils; common associates include fourwing saltbush, littleleaf horsebrush, and greasewood	Potential to occur, though not observed during surveys.
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, though not observed during surveys.
Invertebrates		
Pallid wood nymph *Cercyonis oetus pallescens*	Alkaline flats	Potential to occur.

Table 11: BLM Sensitive Species Potentially Occurring within the Project Area

Species	Habitat	Potential for Occurrence
Carson valley wood nymph *Cercyonis pegala carsonensis*	Wet meadows	Potential to occur.
Great Basin small blue *Philotiella speciosa septentrionalis*	Unknown	Unknown.
Birds		
Golden eagle *Aquila chrysaetos*	Variety of open and semi-open landscapes with sufficient mammalian prey base and cliff sites for nesting	Confirmed.
Ferruginous hawk *Buteo regalis*	Grasslands and semi-desert shrublands; nest in isolated trees, on rock outcrops, or ground	Potential to occur.
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. Ample cliffs for nesting and shrublands for foraging.
Swainson's hawk *Buteo swainsoni*	Usually occurs close to riparian or other wet habitats; forages over agricultural fields, wet meadows, or open shrublands	Confirmed. Observed within Project Area during surveys.
Burrowing owl *Athene cunicularia*	Treeless areas with low vegetation and burrows	Potential to occur.
Loggerhead shrike *Lanius ludovicianus*	Open country with scattered trees and shrubs, desert scrub; nests in shrubs or small trees	Confirmed. Observed within Project Area during surveys.
Vesper sparrow *Pooecetes gramineus*	Plains, prairie, dry shrublands, savanna, weedy pastures, fields, sagebrush, arid scrub, and woodland clearings	Potential to occur.
Gray vireo *Vireo vicinior*	Hot, semi-arid, shrubby habitats	Potential to occur.
Snowy plover *Charadrius alexandrinus*	Alkali flat, mudflat, or flat beach adjacent to permanent or seasonal surface water	Potential to occur.
Long-billed curlew *Numenius americanus*	Grasslands and irrigated agricultural fields	Potential to occur.
Mammals		
Western pipistrelle bat *Pipistrellus hesperus*	Deserts and lowlands, desert mountain ranges, desert scrub flats, and rocky canyons	Potential foraging habitat.

Table 11: BLM Sensitive Species Potentially Occurring within the Project Area

Species	Habitat	Potential for Occurrence
Pallid bat *Antrozous pallidus*	Arid deserts and grasslands, often near rocky outcrops and water	Potential foraging habitat.
Spotted bat *Euderma maculatum*	Various habitats from desert to montane, including canyon bottoms, and open pastures	Potential foraging habitat.
Silver-haired bat *Lasionycteris noctivagans*	Prefers forested areas adjacent to lakes, ponds, and streams	Potential foraging habitat.
Townsend's big-eared bat *Corynorhinus townsendii*	Maternity and hibernation colonies typically in caves and mine tunnels	Potential foraging habitat.
Big brown bat *Eptesicus fuscus*	Various wooded and semi-open habitats including cities	Potential foraging habitat.
Hoary bat *Lasiurus cinereus*	Prefers deciduous and coniferous forests and woodlands	Potential foraging habitat.
Brazilian free-tailed bat *Tadarida brasiliensis*	Roosts primarily in caves	Potential foraging habitat.
Long-eared myotis *Myotis evotis*	Mostly forested areas; also shrubland, along wooded streams, over reservoirs	Potential foraging habitat.
Fringed myotis *Myotis thysanodes*	Desert, grassland, and wooded habitats	Potential foraging habitat.
California myotis *Myotis californicus*	Western lowlands; canyons, riparian woodlands, desert scrub, and grasslands	Potential foraging habitat.
Small-footed myotis *Myotis ciliolabrum*	Desert, badland, and semi-arid habitats	Potential foraging habitat.
Little brown myotis *Myotis lucifugus*	Adapted to using human-made structures; also uses caves and hollow trees	Potential foraging habitat.
Long-legged myotis *Myotis volans*	Primarily in montane coniferous forests; also in riparian and desert habitats	Potential foraging habitat.
Desert bighorn sheep *Ovis canadensis nelsoni*	Steep slopes on or near mountains with a clear view of surrounding area	Suitable habitat within the Stillwater Range adjacent to Project Area.
Source: BLM 2010; GBBO 2010; NatureServe 2011; Wildlife Action Plan Team 2006		

3.14.2.3 Plants

Two BLM sensitive plant species could potentially occur within the Project Area based on literature reviews and habitat assessment. Generally, the habitats within the Project Area are not sandy enough for the Nevada dune beardtongue, but based on the habitat associations for this

species, the species could occur. Neither species was observed during the field survey; in fact, no *Penstemon* species were observed. The NNHP indicated that potential habitat exists for Candelaria blazingstar (*Mentzelia candelariae*), which is not a BLM sensitive species, but is considered at-risk by the NNHP. This species has not been recorded within the Project Area (NNHP 2011).

3.14.2.4 Invertebrates

Three BLM sensitive invertebrate species (see Table 11) could potentially occur within the Project Area based on literature reviews and habitat assessment. Little published literature is available regarding the ecology of these species, which makes the likelihood of occurrence determination uncertain.

3.14.2.5 Raptors

Golden Eagle

Stick nests or whitewash were not observed during the ground survey, but were noted in the aerial survey data. Suitable nesting habitat for golden eagles occurs throughout the Stillwater Range bounding Dixie Valley, as this range has rock outcrops with expansive views of the surrounding territory. Three active and eight inactive nests were recorded in the Stillwater Range in the vicinity of the project. The Dixie Valley provides habitat for golden eagle prey, such as rabbits, hares (e.g., jack rabbits), and ground squirrels. In addition, golden eagles have been reported at the existing TGP Dixie Valley power plant about 3 miles north of the Project Area.

Burrowing owl

Burrowing owls rely on other species to construct burrows for shelter and nesting. Within the Project Area, limited suitable burrow opportunities were observed, although some coyote dens and other burrows were noted during field surveys. No burrow examined had characteristic scat or pellets usually found with burrowing owl use.

Swainson's hawk

Swainson's hawk was observed foraging within the Project Area, although suitable nesting habitat is not present.

Other raptors

Ferruginous hawk and prairie falcon could occur within the Project Area, as there are suitable rock outcrops for nesting in the Stillwater Range, and shrublands for foraging. These species were not observed during field surveys.

3.14.2.6 Other Avian Species

Loggerhead shrike was observed within the Project Area during surveys, and potential nesting habitat is present. Other potentially occurring species include vesper sparrow, gray vireo, snowy plover, and long-billed curlew.

3.14.2.7 Mammals

Bats

Potential foraging habitat exists throughout the Project Area for the fourteen BLM Sensitive bat species listed in Table 11. No bats were observed during the field survey, and no potential maternity or hibernation habitats were observed within the Project Area. Some bats (e.g., pallid bat, California myotis, and small-footed myotis) may use rock outcrops within the nearby Stillwater Range. There are also some caves and adits within the Stillwater Range that could be used by bats.

Bighorn sheep

Bighorn sheep have been recorded within the Stillwater Range (BLM 2010) and thus could utilize the Project Area for foraging on grass, forbs, and shrubs and connection to the Tobin Range, which is also occupied habitat. Water is available at Dixie Meadows to the south of the Project Area. Bighorn sheep were not observed during the field survey.

3.14.3 Environmental Consequences

3.14.3.1 Threatened or Endangered Species

Because no threatened or endangered species were observed during field surveys or are known to exist in the Project Area, there would be no impacts to threatened or endangered species from the Proposed Action (USFWS 2011).

3.14.3.2 BLM Sensitive Species

No sensitive bat roosting habitat, rare plants, or sensitive invertebrate species are expected to be disturbed due to implementation of the Proposed Action. However, indirect impacts could occur, as approximately 113 acres of habitat would be disturbed in the Project Area during the life of the Proposed Action. Effective habitat loss from the disturbance and fragmentation may encompass a larger area for some bat species. Bat species in the area are insectivorous and it is not expected that insect populations would be adversely affected by construction activities. There are large tracts of similar habitat in the vicinity of the Project Area for bats to forage; therefore, no impacts to sensitive bat species are anticipated.

In the Project Area (including the gravel pit areas), BLM sensitive avian species (including golden eagle, Swainson's hawk and loggerhead shrike) would lose approximately 113 acres of habitat as a result of the Proposed Action. Effective habitat loss from disturbance and fragmentation may encompass a larger area for some avian species. Indirect effects from noise and increased human activity could temporarily displace and reduce breeding success of these sensitive avian species; however, the species would be able to return to the disturbed areas upon completion of ground-disturbing activities. No population-level impacts to the sensitive avian species are expected as a result of implementation of the Proposed Action. Because sensitive avian species would likely return to the area after construction is complete and because similar habitat is available near the Project Area, impacts to sensitive avian species are expected to be minor from implementation of the Proposed Action. There are large tracts of similar habitat in

the vicinity of the Project Area; therefore, no impacts to BLM sensitive avian species are anticipated.

As discussed in Section 2.1.10, components of the Proposed Action that would result in direct habitat loss within migratory bird nesting habitat would either occur prior to the nesting season or nest surveys would be conducted by a qualified biologist acceptable to the BLM prior to implementation. If nests are found, coordination with the BLM would occur to develop appropriate protection measures, which may include avoidance, timing constraints, and/or buffers.

Bighorn sheep habitats within the Stillwater Range are not anticipated to be disturbed by construction or drilling activities because drilling and road construction would not occur in these areas. Therefore, no impacts to bighorn sheep are expected as a result of the implementation of the Proposed Action.

3.15 CULTURAL RESOURCES

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

3.15.1 Affected Environment

The basic cultural chronology of the western Great Basin includes the Pre-Archaic and Archaic Periods (Elston 1986). More detailed background information for the prehistoric, historic, and ethnographic resources found in the area can be found in the cultural resources report conducted for the Coyote Canyon Geothermal Utilization Project (Young and Garner 2009). Below is a very brief summary of 12,000 years of human occupation in western Nevada.

The Pre-Archaic period is defined by artifacts including Clovis and Folsom fluted lanceolate projectile points and Lake Mojave lanceolate projectile points. Reliance on big game hunting dominated the Pre-Archaic subsistence strategy. The main indicator of the shift to the Archaic period is a change to a broader strategy focused on hunting and gathering of resources. Projectile points became smaller and more suited for hunting smaller game, although they were still mounted on the ends of a dart or spear, and there was an increase in the number and type of stone grinding implements used for plant and seed processing. Material culture diversified greatly with the contemporaneous introduction of pottery and the bow and arrow with smaller projectile points. By around A.D. 1200, an expansion of Numic-speaking peoples into the area seems to

have replaced or displaced the previous inhabitants (Bettinger and Baumhoff 1982). Archaeologically, the primary material culture of the Numic includes Intermountain Brownware pottery and Desert Side Notched and Cottonwood Triangular arrow points. The subsistence strategy appears to have shifted back to a focus on hunting and gathering, although there is some evidence of at least limited reliance on horticulture. The Numic-speaking peoples, including the Northern Paiute, were the occupants of the Great Basin upon the initial arrival of Europeans and their influences.

Recent cultural resources investigations of the area included a Class I literature review of both State of Nevada and BLM Carson City field office cultural resources files and a Class III pedestrian inventory of the Coyote Canyon project area to the north. For this current project area, a 3,386-acre Class III cultural resources inventory was conducted in April 2011 (Lennon 2011). The results of the survey have been analyzed in conjunction with the previous inventories.

The April 2011 survey area was not previously inventoried for cultural resources. Results from the survey included four previously recorded sites identified within a 1-mile buffer of the Project Area (Hause 1994). All of these sites are prehistoric. One of the sites was identified as eligible for listing to the NRHP, two were identified as not eligible, and one was not evaluated for eligibility.

Additionally, 26 newly recorded sites were identified. Of these 26 sites, 16 are historic, six are prehistoric and four are multi-component sites. Five of the historic sites are military related from the World War II era. The remaining historic sites are from the modern era and attributed to road-side dumping, consisting of domestic and/or construction materials. The six prehistoric sites and prehistoric component of the multi-component sites belong to the Middle to Late Archaic/Late Prehistoric time period.

Two of the prehistoric sites and two of the multi-component sites have been determined to be eligible for listing to the NRHP based on the potential to yield data that would contribute to the understanding of the prehistoric occupation of the area. All recommendations for site eligibility for listing on the NRHP are based on preliminary field recommendations and are subject to review and possible changes during BLM and State Historic Preservation Office (SHPO) consultations.

Thirty-seven isolated finds were also recorded. Ten of those finds are prehistoric, most likely from the Middle to Late Archaic/Late Prehistoric periods. Twenty-seven are historic, mostly early to mid-20th century, with some finds identified as being from the late 19th century.

The three 15-acre gravel extraction areas were surveyed by BLM archaeologist Jason Wright in August 2012. The results were negative and no historic properties were found.

3.15.2 Environmental Consequences

The Proposed Action currently has the potential to impact six archeological sites recommended as eligible for NRHP listing within the project area. To avoid impacts, the Proposed Action would implement the proposed mitigation measures identified in Section 2.1.10 and avoid archeological sites recommended eligible for NRHP listing.

Consultation with the SHPO on Determinations of Eligibility and Finding of Effect for cultural resources located within the Proposed Action area is ongoing. Construction and operation of the Proposed Action would avoid all known resources identified during the survey activities in accordance with the State Protocol Agreement between the BLM and the SHPO for Implementing the National Historic Preservation Act, 2009, Appendix G., Sections A and B (BLM and SHPO 2009).

Implementation of the Proposed Action also has the potential to affect undiscovered or subsurface resources.

Based on the avoidance of known sites and the established protocol for the discovery of any new site, there would be no impact on cultural resources.

3.16 NATIVE AMERICAN RELIGIOUS CONCERNS

3.16.1 Affected Environment

Consultation was initiated with the Fallon Paiute-Shoshone Tribe on September 15th 2009, for the original Coyote Canyon Geothermal Exploration Project, covering the area directly adjacent (to the north) of the Proposed Action. Correspondence included a description of the Proposed Action, cultural resource reports, and a map. This letter was followed by face-to-face meetings between the BLM Stillwater Field Office Manager and the Tribe on August 25th 2010, October 26th 2010 and April 27th 2011.

Additional face-to-face meetings were held between BLM Stillwater Field Office archaeologists and the Tribe on September 15th 2010, December 22nd 2010, and May 25th 2011, and included a field trip to the project area on September 28th 2010.

3.16.2 Environmental Consequences

Consultation regarding the Proposed Action area between the BLM and federally recognized Native American tribes is ongoing. During consultation for the Proposed Action, cultural resources including historic properties and other resources were identified and potentially may be affected by the Proposed Action.

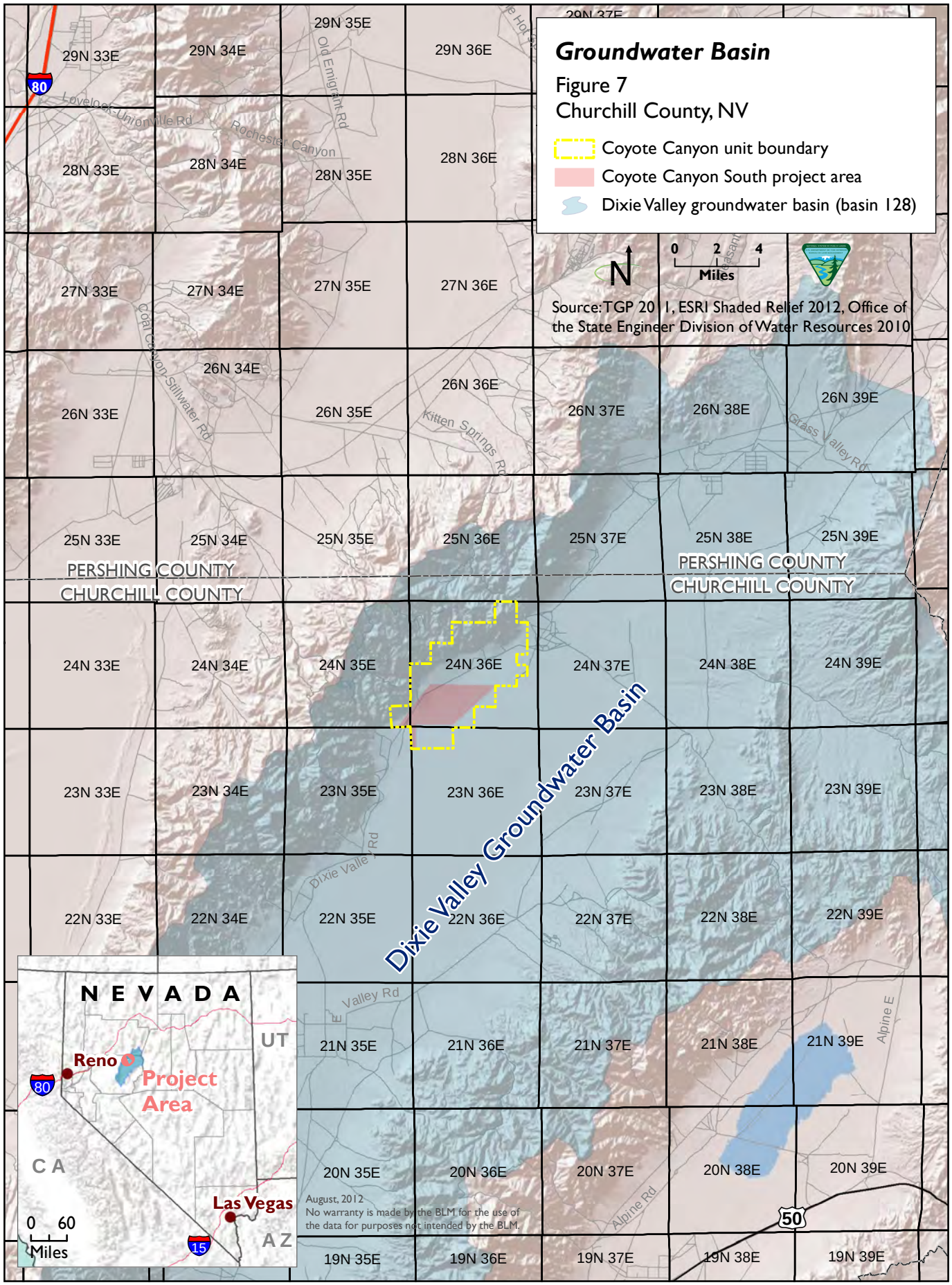
Archaeological sites can and would be avoided through project design. If human remains are identified during construction of any of the components of the Proposed Action, work within 300 feet of the discovery would be stopped and the remains would be protected from further exposure or damage. If the remains are determined to be Native American, the agencies would follow the procedures set forth in 43 CFR Part 10, Native American Graves Protection and Repatriation Regulations.

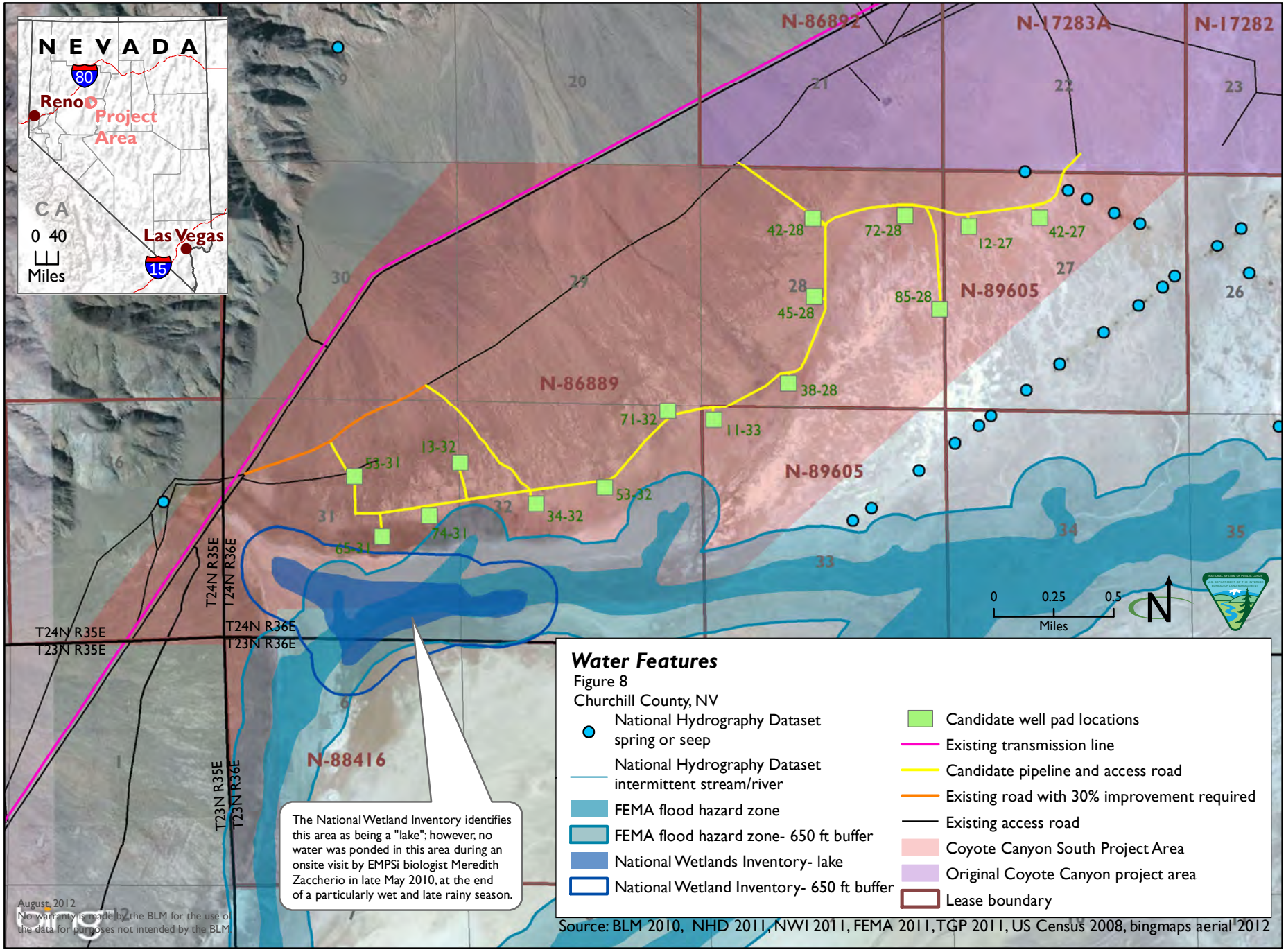
3.17 NO ACTION ALTERNATIVE

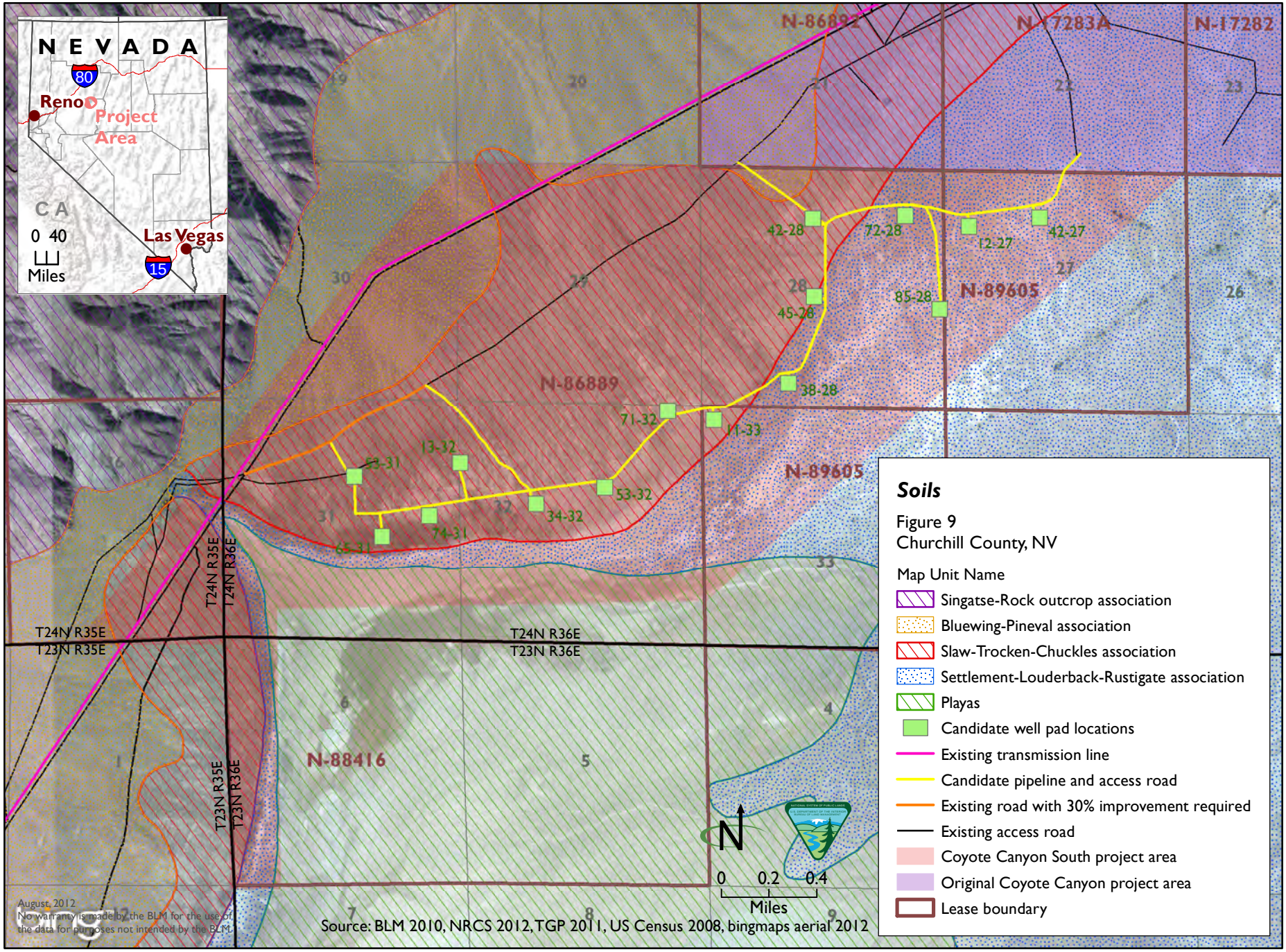
Project features would not be constructed under the No Action Alternative. Therefore, none of the resources described in Chapter 3 would be affected by the Proposed Action.

3.18 RESIDUAL IMPACTS

Solid waste would be generated as a result of the Proposed Action, resulting in residual impacts. The waste would be disposed in approved, permitted disposal facilities. Impacts to vegetation and soils would be mitigated by interim and final reclamation process. Impacts to wildlife, including migratory birds and sensitive species, would be temporary. The potential introduction of invasive, non-native species as a result of the Proposed Action would be minimized through the use of BMPs but some potential for the spread of nonnative species could remain once all reclamation procedures have been completed.


Groundwater Basin
Figure 7
Churchill County, NV
Coyote Canyon unit boundary
Coyote Canyon South project area
Dixie Valley groundwater basin (basin 128)
N
0 2 4
Miles
Source: TGP 2011, ESRI Shaded Relief 2012, Office of the State Engineer Division of Water Resources 2010
29N 33E
29N 34E
29N 35E
29N 36E
28N 33E
28N 34E
28N 35E
28N 36E
27N 33E
27N 34E
27N 35E
27N 36E
26N 33E
26N 34E
26N 35E
26N 36E
26N 37E
26N 38E
26N 39E
25N 33E
25N 34E
25N 35E
25N 36E
25N 37E
25N 38E
25N 39E
PERSHING COUNTY
CHURCHILL COUNTY
24N 33E
24N 34E
24N 35E
24N 36E
24N 37E
24N 38E
24N 39E
23N 33E
23N 34E
23N 35E
23N 36E
23N 37E
23N 38E
23N 39E
22N 33E
22N 34E
22N 35E
22N 36E
22N 37E
22N 38E
22N 39E
21N 35E
21N 36E
21N 37E
21N 38E
21N 39E
20N 35E
20N 36E
20N 37E
20N 38E
20N 39E
19N 35E
19N 36E
19N 37E
19N 38E
19N 39E
Dixie Valley Groundwater Basin
Lovelock-Unionville Rd
Rochester Canyon
Old Emigrant Rd
Coal Canyon-Stillwater Rd
Kitten Springs Rd
Grass Valley Rd
Dixie Valley Rd
Valley Rd
Alpine Rd
Alpine E
80
50
15
NEVADA
UT
CA
AZ
Reno
Project Area
Las Vegas
0 60
Miles
August, 2012
No warranty is made by the BLM for the use of the data for purposes not intended by the BLM.


NEVADA
80
Reno
Project Area
CA
0 40
Miles
Las Vegas
15
N-86892
N-17283A
N-17282
N-89605
N-86889
N-88416
42-28
72-28
12-27
42-27
28
45-28
85-28
38-28
71-32
11-33
13-32
53-31
53-32
34-32
74-31
65-31
T24N R35E
T24N R36E
T23N R35E
T23N R36E
0 0.25 0.5
Miles
N
The National Wetland Inventory identifies this area as being a "lake"; however, no water was ponded in this area during an onsite visit by EMPSi biologist Meredith Zaccherio in late May 2010, at the end of a particularly wet and late rainy season.
August, 2012
No warranty is made by the BLM for the use of the data for purposes not intended by the BLM.
Water Features
Figure 8
Churchill County, NV
National Hydrography Dataset spring or seep
National Hydrography Dataset intermittent stream/river
FEMA flood hazard zone
FEMA flood hazard zone- 650 ft buffer
National Wetlands Inventory- lake
National Wetland Inventory- 650 ft buffer
Candidate well pad locations
Existing transmission line
Candidate pipeline and access road
Existing road with 30% improvement required
Existing access road
Coyote Canyon South Project Area
Original Coyote Canyon project area
Lease boundary
Source: BLM 2010, NHD 2011, NWI 2011, FEMA 2011, TGP 2011, US Census 2008, bingmaps aerial 2012


NEVADA
80
Reno
Project Area
CA
0 40
Miles
Las Vegas
15
N-86892
N-17283A
N-17282
N-89605
N-86889
N-88416
42-28
72-28
12-27
42-27
28
45-28
85-28
38-28
71-32
11-33
13-32
53-31
53-32
34-32
74-31
65-31
T24N R35E
T24N R36E
T23N R35E
T23N R36E
N
0 0.2 0.4
Miles
Soils
Figure 9
Churchill County, NV
Map Unit Name
Singatse-Rock outcrop association
Bluewing-Pineval association
Slaw-Trocken-Chuckles association
Settlement-Louderback-Rustigate association
Playas
Candidate well pad locations
Existing transmission line
Candidate pipeline and access road
Existing road with 30% improvement required
Existing access road
Coyote Canyon South project area
Original Coyote Canyon project area
Lease boundary
August, 2012
No warranty is made by the BLM for the use of the data for purposes not intended by the BLM.
Source: BLM 2010, NRCS 2012, TGP 2011, US Census 2008, bingmaps aerial 2012

4.0 CUMULATIVE EFFECTS

Cumulative Impacts are defined by the CEQ in 40 CFR 1508.7 as "impacts on the environment which result from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." Cumulative impacts can result from individually minor but collectively significant actions taking place over time. The analysis area for the cumulative impact analysis is the same as the analysis area for each resource found in Chapter 3.

4.1 PAST AND PRESENT ACTIONS

Current land use activities in the vicinity include geothermal energy production, military operations, dispersed casual recreation, hunting units 182 and 183 (mule deer and desert bighorn sheep in particular), and livestock grazing. In the past, mining claims were active in the vicinity, but no mining activities are currently known. A BLM ROW planning corridor exists within Dixie Valley with the express purpose of providing an outlet for geothermal power to be produced in the valley (BLM 2001). Currently, there is a transmission line within this corridor, and the 62-megawatt Dixie Valley Power Plant has been producing energy for more than 20 years. Multiple geothermal leases are currently authorized and geothermal exploration is permitted in the original Coyote Canyon area directly to the north of the Project Area, as well as in Dixie Meadows to the south. A power plant and well field development has also been approved in the Coyote Canyon lease area.

4.2 REASONABLY FORESEEABLE FUTURE ACTIONS

Reasonably foreseeable future actions constitute those actions that are known or could reasonably be anticipated to occur within the analysis area for each resource, within a time frame appropriate to the expected impacts from the Proposed Action. For the Proposed Action, the time frame for potential future actions is reasonably assumed to be 3 years. Reasonably foreseeable future actions include dispersed recreation, including off-highway vehicle use and hunting; continued geothermal energy production from the Dixie Valley Power Plant; and geothermal exploration and development in the original Coyote Canyon area as well as in Dixie Meadows. There are plans by Churchill County to obtain water from the Dixie Valley groundwater basin.

4.3 CUMULATIVE IMPACTS

Cumulative impacts are discussed below for those resources that had anticipated impacts described in Chapter 3.

4.3.1 Air Quality

Air quality impacts from the Proposed Action would consist only of temporary impacts during well construction, including fugitive dust from gravel extraction, construction vehicles and hydrogen sulfide emissions during well testing. If gravel extraction or well installation activities are performed concurrently at other sites, the Proposed Action could contribute to a cumulative temporary increase in fugitive dust and hydrogen sulfide emissions. These impacts would be minimized through the use of the BMPs described in Section 3.2.3.

4.3.2 Water Quality

When combined with other current and potential future area activities, such as other geothermal development, there would be an increased potential for impacts to surface water and groundwater quality. Potential impacts to groundwater quality would be minimized through the use of BMPs for well construction. Percolation of geothermal fluids from well testing could have a temporary local impact on groundwater quality and water levels. Potential impacts to surface water would be temporary and local, and would be minimized through the use of BMPs.

4.3.3 Visual Resources

Visual impacts from the Proposed Action would be limited and would occur primarily during the construction process. If other geothermal exploration activities in the original Coyote Canyon lease area were to take place at the same time, the Proposed Action could contribute to a temporary cumulative impact on visual resources. This contribution would be largely limited to the duration of construction when drill rigs are present onsite because any remaining structures would be low-level and not visible from a distance.

4.3.4 Biological Resources

The Proposed Action would have impacts on biological resources. Vegetation and habitat would be disturbed and removed, and invasive, non-native plant species may spread as a result of the Proposed Action. The maximum disturbance associated with the Proposed Action of 113 acres would combine with the disturbances estimated for the original Coyote Canyon exploration project of 73 acres and the Coyote Canyon development project of 61 acres, for a total cumulative impact area of up to 247 acres. Other development in the area may also remove vegetation and increase growth of invasive species. However mitigation measures including reseeding of disturbed areas, monitoring and treatment of invasive species would reduce potential impacts. Wildlife habitat, including habitat for migratory birds and BLM sensitive species, could be disturbed or removed due to other development in the area. Human activity and noise could displace wildlife to surrounding areas. However, 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 biological resources within the analysis area.

4.3.5 Cultural Resources

Class III cultural resource investigations of the area adjacent to the Project Area were conducted in July 2009 (Young and Garner 2009), June 2010 (Spurling 2010), and September 2010 (Spurling 2010). Portions of the Project Area and adjacent areas were surveyed for cultural resources, either by Far Western (Young and Garner 2009), SWCA Environmental Consultants (Spurling 2010), or by other recent investigations in the area for small geothermal exploration or testing projects (McGuire 1993).

The types of impacts noted to affect cultural resources are common for many surface disturbing activities; whenever an activity breaks the surface, there is the possibility for discovering new sites that would contribute to the historic record for a region. All of the new sites noted for this project as well as past projects have contributed to enriching the region's history and our

understanding of the past. New sites discovered as a result of this project or other projects in the surrounding area would also contribute to the scientific database and context of the region.

Additionally, surface activities from past, present and future activities, regardless of the jurisdiction in which they occur, could impact cultural resources through damage or destruction of artifacts and/or features. Once lost, whether through loss of scientific knowledge and context or actual damage to the artifact(s), the loss is irretrievable and permanent. However, actions that occur under the BLM's jurisdiction have numerous mitigation measures available in order to avoid or lessen these impacts; activities occurring in other jurisdictions may or may not have similar measures. The more protections available to prevent damage to artifacts and loss of scientific knowledge would lessen the overall cumulative impact from surface disturbing activities.

4.3.6 Native American Concerns

Much of the state of Nevada is part of the traditional Paiute and Western Shoshone lands occupied for centuries before Europeans arrived, and the land maintains cultural significance for the Fallon Paiute-Shoshone tribe and other tribal communities. Over the last couple of decades more activities have begun encroaching on what has been a largely unpopulated and pristine environment. Increases in livestock grazing, oil and gas exploration, geothermal exploration and development, mining, and recreational activities such as OHV, hunting and fishing, hiking, and mountain biking have become more common in the vicinity. These multiple uses, and the increased frequency of them, contribute to the overall decline in cultural resource sites and traditional cultural properties significant to the spiritual or cultural identities of the Native American Tribes.

In order to minimize the potential cumulative contribution of the Proposed Action to impacts such as these, BLM Stillwater Field Office and the Fallon Paiute-Shoshone Tribe and other tribal groups need to maintain an open and honest dialog in managing public lands. All interested parties need to remain flexible in their approach to making decisions on how to administer the multiple activities taking place on public lands. Through productive communications and understanding the needs of the other parties, the decisions made on how to manage the land can reduce or eliminate impacts to any party's interests on public lands.

4.3.7 No Action Alternative

Under the No Action Alternative, the project site would not be explored for geothermal resources at this time and would be available for development in the future. There would be no impacts to any of the identified resources or activities from implementation of the No Action Alternative.

All resource values have been evaluated for cumulative impacts. It has been determined that cumulative impacts would be negligible as a result of the Proposed Action or No Action Alternative.

5.0 CONSULTATION AND COORDINATION

5.1 AGENCIES, GROUPS, AND INDIVIDUALS CONTACTED

Table 12, Agencies, Groups, and Individuals Contacted, presents the individuals contacted for the preparation of the original Coyote Canyon project directly to the north. Since the Proposed Action is nearly identical to the originally proposed project, is being proposed as an expansion to that original exploration plan, and since the location is directly adjacent to the original project with no additional resource issues identified, separate consultation and coordination was determined to be unnecessary prior to the release of this EA. All agency feedback on that original project was incorporated into this EA.

Table 12: Agencies, Groups, and Individuals Contacted

Name	Agency	Project Expertise
Jeryl Gardner	Bureau of Water Pollution Control, NDEP	Water Resources
Kristine Hansen	USACE, Reno District Office	Wetlands and Waters of the U.S.
Karen Clementsen	USACE, Reno District Office	Wetlands and Waters of the U.S.
Tom McKay	Natural Resource Conservation Service	Soils
Melissa Marr	Nevada Division of Water Resources (DWR)	Water Resources
Ken Haffey	Nevada Division of Water Resources (DWR)	Water Resources
Commanding Officer	NAS Fallon	Air Space
Alvin Moyle	Chairman Fallon Paiute Shoshone Tribe	Native American Consultation
Rochanne Downs	Vice Chairperson Fallon Paiute Shoshone Tribe	Native American Consultation
Richard Black	Fallon Paiute Shoshone Tribe	Native American Consultation

5.2 LIST OF PREPARERS

Table 13, List of Preparers, presents the individuals who contributed to the preparation of this EA. Much of the analysis presented in this EA was identical to the original EA for exploration at Coyote Canyon, and so substantial portions of text from that analysis were used. The original Coyote Canyon Exploration EA was prepared by CH2M HILL.

Table 13: List of Preparers

Name	Title	Project Expertise
BLM Stillwater Field Office		
Ed Klimasauskas		PM
Linda Appel		Air Quality, Floodplains, Wetlands/Riparian Zones
Jill Devaurs		Invasive, Nonnative and Noxious Species
John Wilson		Migratory Birds, Wildlife/Key Habitat, BLM Sensitive Species
Ken Depaoli		Minerals
Eric Pignata		Lands and Realty
Dan Westermeyer		Visual Resources
John Axtell	Wild Horse and Burros Specialist	Wild Horses and Burros
Dave Schroeder	Reclamation Compliance Specialist	Wastes, Hazardous or Solid
Coreen Francis	Staff Supervisor Stillwater Field Office	Forest and Rangelands (HFRA Projects Only)
Angelica Rose	Planning and Environment Coordinator	NEPA
Jason R. Wright	Archeologist	Cultural Resources, Native American Religious Concern
Steve “Chip” Kramer	Planning and Environment Coordinator	NEPA
Intertech Services Corporation		
Mike Baughman	Consultant	NEPA compliance, senior review
EMPSi		
Andrew Gentile	Environmental Planner	Project Manager, NEPA
Meredith Zaccherio	Senior Biologist	Biological Resources
Matt Kluvo	Biologist	Biological Resources
Jenna Jonker	GIS Analyst	Soils
Laura Long	Editor	Water Resources

6.0 REFERENCES

APLIC (Avian Power Line Interaction Committee). 2006. Suggested practices for avian protection on power lines: the state of the art in 2006. Edison Electric Institute, APLIC, and the California Energy Commission. Washington, DC and Sacramento, CA.

Bettinger and Baumhoff. 1982. *The Numic Spread: Great Basin Cultures in Competition*. American Antiquity 47(3): 485-503.

Bruton, C.J., D. Counce, D. Bergfeld, F. Goff, S.D. Johnson, J.N. Moore, and G. Nimz. 1997. *Preliminary Investigation of Scale Formation and Fluid Chemistry at the Dixie Valley Geothermal Field, Nevada*. Lawrence Livermore National Laboratory. Preprint UCRL-JC-127850. Available at http://www.osti.gov/energycitations/purl.cover.jsp?purl=/632507-smYPDM/webviewable/

BLM and SHPO (Bureau of Land Management and State Historic Preservation Office). 2009. State Protocol Agreement between The Bureau of Land Management, Nevada and The Nevada State Historic Preservation Office for Implementing the National Historic Preservation Act. Appendix G, Sections A and B.

CEQ (Council on Environmental Quality). 1997. Considering cumulative effects under the National Environmental Policy Act. Council on Environmental Quality, President's Office, Washington, DC, 64 pp. plus app.

Churchill County Planning Department. 2010. *Churchill County Master Plan (2010 Update).*

DOI (United States Department of the Interior). 2008. Departmental Manual 516, Environmental Quality. January.

Elston. 1986. *Prehistory of the Western Area*. In *Great Basin*, edited by W. L. d'Azevedo, pp. 466-498. Handbook of North American Indians, vol.11, W.C. Sturtevant, general editor. Smithsonian Institution, Washington, DC.

Freeman, Dan. 1986. *Screening Analysis for H2S Emissions from Proposed Dixie Valley Geothermal Facility*. Desert Research Institute, Reno, NV

GBBO (Great Basin Bird Observatory). 2010. Nevada Comprehensive Bird Conservation Plan Version 1. Website: http://www.gbbo.org/projects_bcp.html. Site accessed December 2010.

Hause. 1994. Cultural Resources Inventory of a 540 Acre Parcel in Dixie Valley, Churchill County, Nevada. CRR-03-1677 (P).

Karst, Gary B. 1987. *Analysis of the Northern Dixie Valley Groundwater Flow System Using a Discrete-State Compartment Model*. A University of Nevada M.S. Thesis. September.

Lennon. 2011. A Class III Cultural Resource Inventory of 3,386 Acres for the Terra-Gen Power, LLC Mirror Geothermal Exploration Project, Churchill County, Nevada. CRR-3-2571. Prepared by Western Cultural Resouces Management, Inc., Sparks, NV.

McGuire. 1993. *A Cultural resources Inventory of a 1200 Acres Geothermal Development Area in Dixie Valley, Churchill County, Nevada.* BLM Report No. 1570-P. Far Western Anthropological Research Group, Inc., Virginia City, NV.

Mindat.org 2012. The Mineral and Locality Database. Internet Web site: http://www.mindat.org/. Accessed March 15, 2012.

NPS (National Park Service). 1998. Director's Order 28: Cultural Resource Management Guideline. NPS Office of Policy, NPS-28.

NatureServe. 2011. NatureServe Explorer: An Online Encyclopedia of Life. Internet Web site: http://www.NatureServe.org/explorer/index.htm. Accessed July 2011.

Nevada Bureau of Mines and Geology. 2011. *Major Mines of Nevada 2010: Mineral Industries in Nevada's Economy*. University of Nevada, Reno.

Nevada Department of Conservation and Natural Resources, Division of Water Resources (NDCNR-DWR), Office of the State Engineer. 2005. *Designated Groundwater Basins of Nevada*. September.

Nevada Department of Conservation and Natural Resources, Division of Water Resources (NDCNR-DWR). 2009. Internet Web Site: http://water.nv.gov. Accessed in August 2009.

Smith, R.P., K.W. Wisian, and D.D Blackwell. 2001. *Geologic and Geophysical Evidence for Intra-Basin and Footwall Faulting at Dixie Valley, Nevada*. Geothermal Resources Council Transactions. Vol. 25. August 26-29.

Spurling. 2010. Preliminary Report of Findings for the Terra-Gen Power Dixie Valley Coyote Canyon Project, Churchill COUnty, Nevada. BLM Report No. CRR3-2462. SWCA Environmental Consultants Report No. 2010-267, Salt Lake City, UT.

State of Nevada. 1994. State of Nevada State Conservation Commission's Best Management Practices Handbook. December.

TGP. 2009. Personal communication between TGP staff and Amy Lahav/CH2M HILL.

United States Department of Agriculture (USDA) National Resource Conservation Service (NRCS). 2009. Internet Web Site: http://soildatamart.nrcs.usda.gov/Report.aspx?Survey=NV770&UseState=NV. Accessed in August 2009.

United States Department of the Interior, Bureau of Land Management (BLM). 2010. Coyote Canyon and Dixie Meadows Geothermal Exploration Environmental Assessment.

____. 2008a. *Final Programmatic Environmental Impact Statement for Geothermal Leasing in the Western United States*. FES 08-44. October 2008. Available online at: www.blm.gov/wo/st/en/prog/energy/geothermal/geothermal_nationwide/Documents/Final_PEIS.html.

____. 2008b. Carson City District NEPA Compliance Guidebook (Draft).

____. 2008c. Record of Decision and Resource Management Plan Amendments for Geothermal Leasing in the Western United States. BLM-WO-GI-09-003-1800, FES – 08-44. December 2008.

____. 2008d. National Environmental Policy Act Handbook H-1790-1. January.

____. 2007. Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, Fourth Edition (Gold Book).

____. 2001. Consolidated Resource Management Plan. Carson City Field Office, Carson City, NV. May.

____. 1986. Manual H-8410-1 - Visual Resource Inventory.

United States Geological Survey (USGS). 1990.

United States Geological Survey (USGS) National Gap Analysis Program. 2004. Provisional Digital Land Cover Map for the Southwestern United States. Version 1.0. RS/GIS Laboratory, College of Natural Resources, Utah State University.

_____. 2005. Southwest Regional GAP Analysis Project—Land Cover Descriptions. RS/GIS Laboratory, College of Natural Resources, Utah State University.

Wildlife Action Plan Team. 2006. Nevada Wildlife Action Plan. Nevada Department of Wildlife, Reno, Nevada.

Young and Garner. 2009. Archaeological Data Recovery at 26Wa3227: *A Middle Archaic Logistical Camp near the Reno/Stead Airport in Lemmon Valley, Washoe County, Nevada.* BLM Report #CRR3-2112-7. Prepared by Far Western Anthropological Research Group, Inc., Davis, California. Prepared for Sierra Pacific Power Company, Reno, Nevada. Submitted to BLM Carson City Field Office, Nevada.