

## CHAPTER 13

MODOC NATIONAL FOREST

SURPRISE FIELD OFFICE

ENVIRONMENTAL ANALYSIS FOR PENDING LEASE

APPLICATIONS:

CACA 042989, CACA 043744, CACA 043745

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# SECTION 13.1

## PURPOSE AND NEED

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### 13.1.1 INTRODUCTION

This lease-specific analysis describes the environmental effects of leasing the following lands to private industry for the development of geothermal resources:

- Approximately 5,440 acres of National Forest land within the Warner Mountain Forest District of the Modoc National Forest and the Surprise FO;
- Mineral rights on a further 160 acres of private land, adjacent to the National Forest lands, but still within the Surprise FO.

This lease-specific analysis serves as an information resource to aid decision-makers in determining whether these lands are appropriate for leasing under FS and BLM management policies and existing environmental regulations.

The pending lease sites are within the Warner Mountain Ranger District of the Modoc National Forest, which is the surface management agency for the sites. Subsurface mineral rights (including leasable minerals such as geothermal) are managed by the Surprise FO, who issues leases with the consent of the FS (here, the Warner Mountain Forest District of the Modoc NF) for the lands under application in the Modoc NF.

### 13.1.2 LOCAL REGULATORY CONSIDERATIONS

The pending lease application sites are located within Modoc County, California and are subject to state and local regulations, as described below.

#### **State of California Renewable Portfolio Standard Program**

The California Renewable Portfolio Standard Program is a California law that requires investor-owned utilities to obtain 20 percent of the power supplied to customers to be generated from renewable resources by 2017. Geothermal energy is included in the definition of renewable resources under the program.

**Modoc National Forest Land and Resources Management Plan (1991)**

The Modoc NF operates under the direction of the Record of Decision (ROD) for the Modoc Forest Land and Resources Management Plan (Forest Plan) as amended (US Forest Service 2004). In addition to several site specific project amendments the Forest Plan has been amended by the Sierra Nevada Forest Plan Amendment ROD (2004).

The Modoc Forest Plan addresses leasable minerals, including geothermal, and notes that the US Geologic Survey has identified most of the Forest as prospectively valuable for geothermal resources. The Lake City-Surprise Valley area is one of the two acknowledged known geothermal resource areas, and is noted as including approximately 1,880 acres of the eastern edge of the Forest. In 1981, the Regional Forester signed a Decision Notice, which allowed geothermal exploration activities within that portion of the forest. The Notice authorized the issuance of federal leases with certain lease stipulations.

The stipulations in the Notice are less restrictive than those put forth in Appendix I of the Forest Plan, which call for protection of:

- Surface areas with scientific, educational value, developed recreation sites, and other facilities and improvements;
- Active bald eagle nest sites;
- Modoc, shortnose and Lost River Sucker habitat;
- Highly scenic and sensitive visual areas;
- Wildlife during critical periods;
- Wetlands;
- Permitted or leased areas;
- Watershed;
- Surface water sources; and
- Eroding soils.

**Surprise Field Office Resource Management Plan and Final Environmental Impact Statement (2007)**

The pending lease area is within the Surprise FO. Geothermal resources underlying the pending lease sites are managed by the Surprise FO Resource Management Plan and FEIS. The Surprise FO includes approximately 1,220,644 acres of BLM-managed surface acres in northeastern California and northwest Nevada.

The Surprise FO Resource Management Plan acknowledges that geothermal leasing is encouraged, but that activity is sporadic to nonexistent in the field office. It notes that a number of energy companies have expressed interest in

the field office and have conducted low-level analyses of the geothermal potential, but none have resulted in pending lease applications. The Resource Management Plan identifies the Lake City-Surprise area as being the only known geothermal resource area within the field office and anticipates continued interest and activity in the area. The Resource Management Plan notes there is a high potential for at least one proposed geothermal production facility in the field office in the future.

#### **Modoc County General Plan (1988)**

The Modoc County General Plan identifies land use classifications, and restrictions for those classifications. The General Plan would apply to the private lands of CACA 042989.

### **13.1.3 SCOPE OF ANALYSIS AND APPROACH**

This lease-specific analysis incorporates by reference the programmatic analysis presented in Volume I to which this lease-specific analysis is incorporated. This analysis examines the cluster of three pending lease application sites, describes the RFD scenario for this cluster, examines the existing environmental setting, and describes the potential direct, indirect impacts that issuing leases at these sites would have on the human and natural environment.

This report focuses on specific key resource concerns in the cluster, and incorporates by reference the impacts described in the PEIS. Decision-makers should consider both the impacts described in this lease-specific analysis, in addition to those described in the main body of the PEIS. The analysis presented here does not reiterate the details of impacts identified in the PEIS, but rather refers to them as they arise in the impact analysis for pending lease application sites addressed here. Modoc National Forest staff members were contacted during the preparation of this lease-specific analysis to help identify local resource concerns.

### **13.1.4 CUMULATIVE ACTIONS**

Consultation with the Modoc National Forest did not identify any projects that would cumulatively contribute to impacts within the project area.

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## SECTION 13.2

# PROPOSED ACTION AND ALTERNATIVES

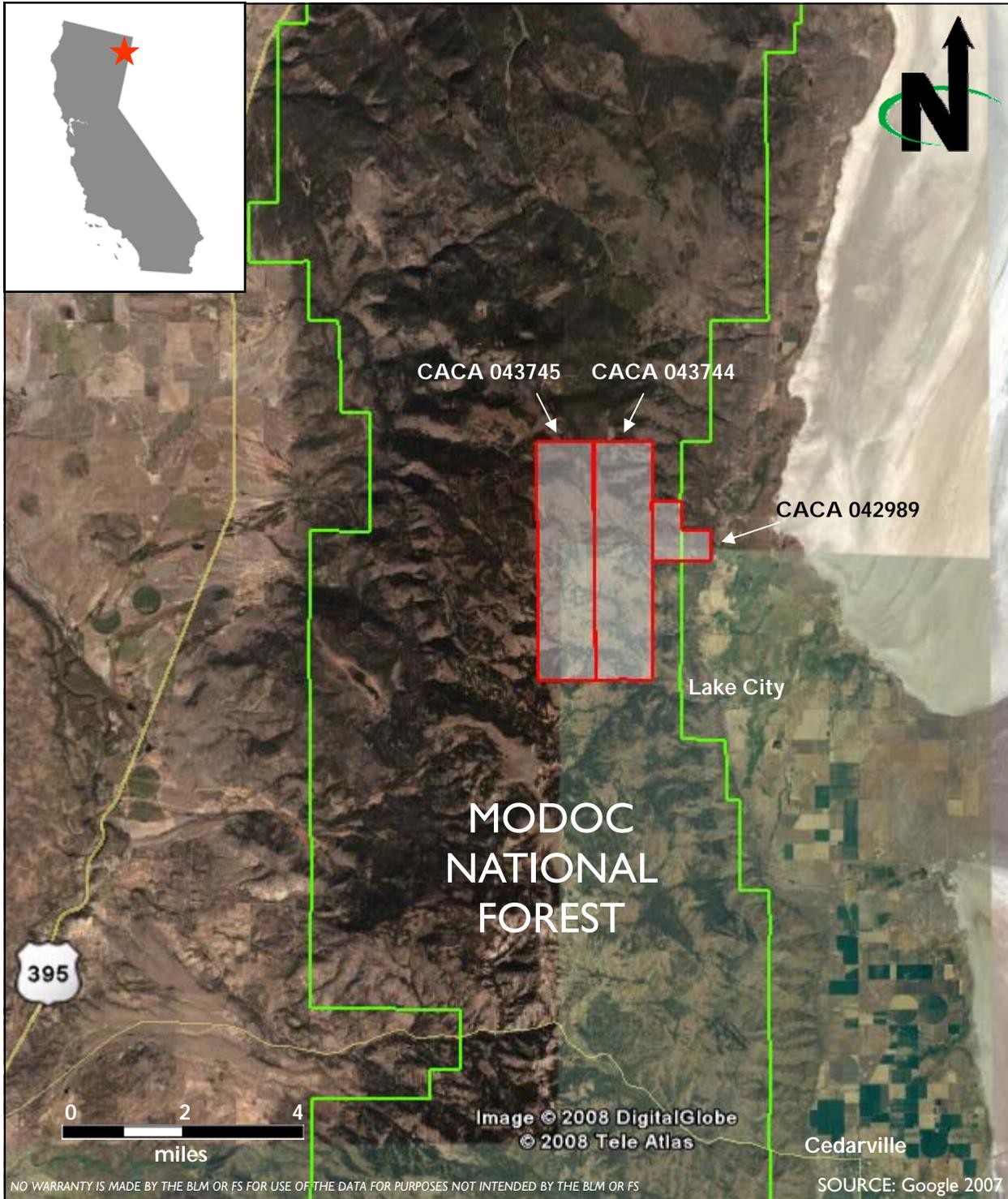
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### 13.2.1 INTRODUCTION

This chapter provides the details of the proposed action, alternatives to the proposed action, a discussion of alternatives considered but eliminated from detailed analysis, and an overview of the reasonably foreseeable develop (RFD) scenario for pending lease application sites CACA 042989, CACA 043744, and CACA 043745.

### 13.2.2 PROPOSED ACTION

The proposed action is to issue leases to private geothermal developers for approximately 5,120 acres of land within the Modoc National Forest, and 480 acres of private land adjacent to the forest. The lands are all contiguous, spanning an area four miles (north to south) by three miles (east to west). The pending lease area encompasses an eastern portion of the Warner Mountains, on the western slopes of the Surprise Valley, 1.2 miles west of Lake City and approximately 8.5 miles north of Cedarville (see Figure 1). Since the pending leases are contiguous, they are discussed together as a group in detail below.



All 3 lease sites are on NFS land, with a portion of CACA 042989 on private land

- LEGEND:**
- Lease site boundary
  - Modoc NF boundary

**Modoc Lease Locations**  
 CACA 042989, 043744, 043745  
 Modoc NF / Surprise FO

Figure I-1

The pending lease area is comprised of three lease sites, all located within Township 44 North, Range 15 East:

- CACA 043745 - Comprised of four sections of land lying in a row, aligned in the north-south direction. As such, the proposed lease site is four miles long by one mile wide and includes 2,560 acres. The proposed lease site is completely within the Modoc NF and includes sections 9, 16, 21, and 28. This site is a focal point for several management activities including fuelwood, hunting, and range management. The site has one of the largest concentrations of both commercial and private fuelwood use. Some of the harvest areas have plantations, where use has caused tree stocking to dip below desired levels. Although hunters only utilize the area seasonally, big game hunting (definitely deer and potentially elk) is also centered in this area. Finally, range management activities including important water sources are both within and adjacent to CACA 043745. Additional activities that have occurred or are planned in the future include prescribed burns and timber harvest. There are units from the Four Corners Sale including plantations in Compartment 312 stands 10 and 11. The area also has been identified for aspen improvement under the Bald Timber Sale. Previous prescribed burns have occurred in 1996 and 2003/2004 (Flores and Carlock 2008).
- CACA 043744 - Comprised of four sections of land lying in a row, aligned in the north-south direction. As such, the proposed lease site is four miles long by one mile wide and includes approximately 2,560 acres. The proposed lease site is completely within the Modoc NF and includes sections 10, 15, 22, and 27. Although some of the activities briefly described in CACA 043745 occur within this potential lease site as well, there are far fewer activities due to the lack of road access and topography. The Forest Service expects that given the nature of the landscape, steep topography, and land stability issues, development of a power plant would be a difficult undertaking (Flores and Carlock 2008).
- CACA 042989 - Comprised of three-quarters of section 14 and includes 480 acres, in an "L" shape. The potential lease site is one mile by one mile along its longest edges. The western two quarters of this the section is within the Modoc NF, and the southeastern quarter section is on private land in Modoc County. The area under Forest control is accessible foot only. The Forest Service considers the topography in the area to be unsuitable for development of facilities (Flores and Carlock 2008).

The potential lease sites are in the Warner Mountain Range at elevations ranging from 4,600 feet in the east to 7,800 at some of the mountain peaks in

the central portions of the pending lease area. The eastern two sites are very steep and have unstable soils; the western site has some steep slopes, but also has areas of gentle terrain at the top of the crest. Active management by the Forest Service takes place only on the western-most portions of the pending lease area.

The pending lease area is completely undeveloped, and is traversed by a few, largely unnamed, unpaved and unmaintained roads, as well as a few trails. Several intermittent creeks are within the pending lease areas, namely Powley, Wilkinson, Boyd, and Mill creeks, as well as two headwater tributaries of the South Fork of Davis Creek. All creeks in the pending lease area drain to Surprise Valley to the east, except for the South Fork of Davis Creek, which runs to the west.

There are no developed adjacent land uses. The nearest residences are located along Surprise Valley Road, between approximately 180 and 230 yards to the east and southeast of lease application site CACA 042989. Aside from farms associated with these residences, there are no other buildings within half a mile of the proposed lease sites in any direction.

### 13.2.3 ALTERNATIVES

Two alternatives are considered in this lease-specific analysis: Alternative A, the No Action alternative, and Alternative B, the Proposed Action.

#### **Alternative A: No Action**

Under Alternative A, the BLM would deny the three pending lease applications.

#### **Alternative B: Proposed Action**

Under Alternative B, the BLM would issue the pending lease applications with the stipulations identified in Chapter 2 of the PEIS.

### 13.2.4 REASONABLY FORESEEABLE DEVELOPMENT SCENARIO

The overall lease area is expected to result in the development of two binary power plants of 20 megawatts each. One of these plants is expected to be developed on the private lands of pending lease application site CACA 042989, and the other is expected on the northwestern portion of pending lease application site CACA 043745. No development is likely on any other portions of the sites due to all other areas being within Inventoried Roadless Areas, as well as the steep topography and land stability issues. Each of the power plants would be expected to result in 10 acres of disturbance for a total disturbance of 20 acres.

Exploration activities for the two 20-megawatt plants is expected to involve approximately 12 temperature gradient holes, disturbing approximately 0.15 acre each, for a total disturbance of approximately 2 acres. Disturbance would

result from the types of activities described under Chapter 2 of the PEIS under *Phase One: Geothermal Resource Exploration*.

Assuming that commercially viable resources are found within both lease areas, drilling operations and development of the sites would be expected to result in a further approximately 6 acres of land disturbance (roughly 3 acres within each lease site) from the types of activities described in the RFD scenario of Chapter 2 of the PEIS under *Phase Two: Drilling Operations*.

Utilization, the third phase of a geothermal project, is expected to result in a further approximately 12 acres of land disturbance (roughly 6 acres at each lease site) from the types of activities described in the RFD scenario of Chapter 2 of the PEIS under *Phase Three: Utilization*. The length and alignment of transmission lines are not estimated here since these factors would depend upon the positioning of any power plant and the distance to the nearest electrical tie-in.

Reclamation and abandonment, the fourth phase of a geothermal project, is expected to result in temporary disturbance of all originally disturbed acres, after which, the site would be graded and vegetated to pre-disturbance conditions, as described in the RFD scenario of Chapter 2 of the PEIS under *Phase Four: Reclamation and Abandonment*.

The pending noncompetitive lease applications for CA 043744 and 043745, which are the larger two of the three proposed lease sites and are the ones located on Forest Service land, were filed by Vulcan Power Corporation in 2001. The pending noncompetitive lease application for lease site CA 042989, the smallest of the three proposed lease sites and the one located partially on private land, was filed by Western Geothermal Partners in 2004.

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# SECTION 13.3

## AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

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### 13.3.1 INTRODUCTION

The following resource disciplines are not addressed in this section because they are not found in the leasing areas and are not relevant to the discussion: wild horses and burros, wild and scenic rivers, and wilderness.

All the pending lease applications are in geologic units that would be expected to have a relatively low potential for containing vertebrate fossils or scientifically significant invertebrate or plant fossils; therefore, paleontological resources are not analyzed in detail. Paleontological mitigative procedures outlined in the PEIS would be followed for all ground distributing activities. Protective measures outlined in the PEIS would be applied.

Future development of the proposed lease sites would also yield the same health and safety impacts as identified in Chapter 4 of Volume I of the PEIS and therefore is not repeated in this lease-specific analysis.

### 13.3.2 LAND USE, RECREATION AND SPECIAL DESIGNATIONS

#### Setting

This section is a discussion of the current land ownership and use within the Region of Influence (ROI) for the two proposed lease sites that are part of the proposed action. The ROI is the land area within and adjacent to the potential lease sites.

#### **Policies and Plans**

It is the policy of the Department of the Interior, consistent with Section 2 of the MMPA and Sections 102(a) (7), (8) and (12) of FLPMA, to encourage the development of mineral resources, including geothermal resources, on federal lands. The Geothermal Steam Act of 1970 provides regulatory guidance for geothermal leasing by the FS and BLM.

Local resource management plans provide direction for activities within the pending lease area. The Surprise FO Resource Management Plan follows the objectives of the Federal Government's policy for mineral resource management. Geothermal leasing and development is therefore consistent with this plan (Bureau of Land Management 2007). Forest-wide standards and guidelines are established in the Modoc Forest Plan, as amended. This Forest Plan encourages exploration and development of mineral resources provided that applicable special stipulations are applied. In addition, mineral development is subject to existing withdrawals and requires a site development and rehabilitation plan prior to use of a site (US Forest Service 1991, 1994, 2004).

### **Regional Setting**

The proposed lease sites are in the western end of the Great Basin in the Warner Mountain Range at elevations ranging from 4,600 feet in the east to 7,800 at some central portions of the pending lease area. The total acreage of the pending lease area is approximately 5,200 contiguous acres in Township 44 North, Range 15 East. Much of the area contains steep slopes, limiting the available land uses. The pending lease area is undeveloped with the exception of a few, largely unnamed, unpaved roads, as well as a few trails.

There are no developed adjacent land uses. Primary uses of the pending lease areas and adjacent land include livestock grazing, developed agriculture, forestry, mineral extraction, and recreation (US Forest Service 1991). The nearest residences are located along Surprise Valley Road, approximately between 180 and 230 yards to the east and southeast of proposed lease site CACA 942989. Aside from farms associated with these residences, there are no other buildings within half a mile of the proposed lease sites in any direction.

The nearest population center is Lake City approximately 1.4 miles to the south of pending lease CA 043744, section 27. Cedarville is approximately 10 miles south east from the same pending lease area.

There are no designated recreation areas within the pending lease area. Common recreation activities in the area include dispersed primitive camping, hiking, stream fishing, deer hunting, Nordic skiing and snowmobiling (US Forest Service 1991). A scenic byway is located to the east side of the pending lease area and a backcountry byway is on land to the west of the pending lease area.

The lands immediately adjacent to the pending lease area include NFS lands and private lands. Public land parcels are found within 2 miles to the north and south of the pending lease area and within 5 miles to the west.

### **Pending Lease Areas**

Lands within the pending lease areas are contained within the Lake City Management Area of Modoc NF. Standards and Guidelines for this area allow for multiple uses including but not limited to semi-primitive non-motorized

recreation, range, and forestry. In addition, the pending lease area is located within the Lake City–Surprise Valley geothermal potential area. Management of the geothermal resource area is within the Sierra Nevada framework amendment to the Modoc Forest Plan (US Forest Service 2004).

Large portions of the pending lease areas are contained within an Inventoried Roadless Area. Although this designation does not specifically preclude leasable mineral use, exploration for and development of leasable minerals in the roadless area would likely be limited because roads are often needed for these activities.

#### *CACA 042989*

Section 14 contains approximately 480 acres of NFS and private lands. The pending lease area consists of steep slopes and drainages containing small streams. The area under forest control is accessible by foot only, and the topography in the area is not suited for development of facilities (Flores and Carlock 2008). All NFS lands within this pending lease site are in an Inventoried Roadless Area. Since there are no existing roads within this lease site, geothermal development would not be permitted on NFS lands within CACA 042989. No developed land uses are found in the pending lease area. Only the private portion of this lease site would be likely for geothermal development. The Surprise Valley/Barrel Springs Back-Country Byway passes within approximately 200 yards of the eastern portion of the private lands portion of the lease area (Bureau of Land Management 2007).

The southeast quarter section of section 14 within CACA 042989 is located on private lands, development on which would be regulated by Modoc County. The Modoc County General Plan identifies the appropriate land use classification for geothermal powerplant operation as being “Heavy Industrial” and defines restrictions on population density, lot coverage, building height. The General Plan indicates that such land uses should be substantially removed from sensitive land uses, including residential areas, hospitals, and schools.

#### *CACA 043744*

This pending lease site is approximately four miles long by one mile wide and includes 2,560 total acres. The site is completely within the Modoc NF and includes sections 10, 15, 22, and 27. This pending lease area consists of primarily undeveloped land with moderate slopes and small drainages containing unnamed streams. Section 27 contains the only road, Lake City Canyon Road, which travels through the SW quarter section. There are no other developed uses in the pending lease area. Nearly the entire lease site is within an Inventoried Roadless Area; the only portion not without this designation is the very northwest corner and western edge of Section 10. Due to the lack of road access in Section 10, and the rugged topography along Lake City Canyon Road, it would not be feasible to construct any geothermal facilities next to existing

roads; therefore, geothermal development activities would not be permitted due to the Inventoried Roadless Area (Flores and Carlock 2008).

#### *CACA 043745*

The proposed lease site is completely within the Modoc NF and includes sections 9, 16, 21, and 28 with a total of approximately 2,560 acres. Section 9 is bisected by a number of unnamed roads traveling north-south. Section 16 contains multiple natural springs in the NWNW area of the section. An unnamed road travels through the western portion of the section. Lake City Canyon Road passes through the center of the section traveling east-west. Approximately 45 percent (mostly the southern two sections) of the pending lease site portion is contained within an Inventoried Roadless Area. There are no existing roads within the Inventoried Roadless Area; therefore, no development would be permitted in this portion of the lease site. Any potential geothermal development would be restricted to the northern half of the pending lease site.

Several management activities occur in the pending lease area. The site has one of the largest concentrations of both commercial and private fuelwood use. Timber harvest and management also occurs in the area. Big game hunting for deer and elk occurs seasonally. Range management activities, including the use of water sources, occurs both within and adjacent to the pending lease area (Flores and Carlock 2008).

### Impacts

#### ***Alternative A (No Action)***

The No Action alternative would have no direct or indirect impact on existing land uses and would not conflict with the Forest Plan, the Surprise FO Resource Management Plan, or the Modoc County General Plan because no ground disturbing activities would be approved.

#### ***Alternative B (Proposed Action)***

The Proposed Action would be consistent with the Forest Plan including the Sierra Nevada Forest Plan Amendment and the Surprise FO Resource Management Plan.

Based on the RFD scenario, it is estimated that a total of two power plants are likely to be developed on the site; one on the private portion of CACA 042989 and one in the CACA 043745. Approximately 10 acres are likely to be disturbed for each plant, for a total of 20 acres of disturbed land within the pending lease area. Details of the standard impacts of geothermal development on land use are discussed in **Section 4.1.3 Land Use, Recreation and Special Designations** of the PEIS.

There is potential that dust and noise disturbance would temporarily alter the recreation experience in and around the pending lease area, but increased roads

and access into the pending lease area may also provide additional recreational opportunities. If development were to occur in the pending lease area, impacts to the visual integrity of the Surprise Valley/Barrel Springs Back-Country Byway would occur. By adhering to the stipulations identified in Appendix B of the PEIS, impacts would be reduced. Other adjacent land uses are not likely to be significantly impacted.

#### *Impacts on Inventoried Roadless Areas*

The status of pending lease land as Inventoried Roadless Areas would likely limit geothermal development in the NFS portions of pending lease site CACA 042989 (NFS land portion), all of CACA 043744 and roughly the southern and eastern portions of CACA 043745. Development in these areas would be consistent with the Inventoried Roadless Area designation as long as no new roads are constructed to access the sites. A No Surface Occupancy stipulation could be applied to all Inventoried Roadless Areas, except for corridors along existing roads, where development may be permitted.

### 13.3.3 GEOLOGIC RESOURCES AND SEISMICITY

#### Setting

The proposed lease site lies within the Great Basin area of the Basin and Range geological province. This province, characterized by steep, elongate mountain ranges alternated with long expanses of flat, dry desert, extends from eastern California to central Utah, and from southern Idaho into the state of Sonora in Mexico. Within the Basin and Range province the earth's crust and upper mantle have been stretched up to 100 percent of its original width. The entire region has been subjected to extension that thinned and cracked the crust as it pulled apart, creating large, north-south trending faults (US Geological Survey 2004).

Expansion occurs in a roughly east-southeast to west-northwesterly direction at the rate of 13 mm/yr (US Geological Survey 2008b). Beginning approximately 20 million years ago, the upthrown side of these faults began to form mountains that rise abruptly and steeply, and the down-dropped side created broad, low valleys, resulting in the provinces' distinctive alternating pattern of linear mountain ranges and valleys. The fault plane extends deep into the crust, usually at a 60 degree angle. In places, the relief or vertical difference between the two sides is as much as 10,000 feet. As the ranges rise, they are immediately subject to weathering and erosion from water, ice, wind, and other agents (US Geological Survey 2004).

The mountain ranges consist of complexly deformed late Precambrian and Paleozoic rocks and some Mesozoic granitic rocks in the western part of the province. Cenozoic volcanic rocks are widespread throughout the province. Eroded material washes down mountain side, often covering young faults until

they rupture again. Sediment collects in adjacent valleys, in some places covering bedrock under thousands of feet of rock debris (US Geological Survey 2004).

In the past 150 years, there have been 14 earthquakes in the Great Basin large enough to rupture the earth's surface. Roughly 20 percent of the faults in this area have evidence of surface rupture in the past 15,000 years. Except for aftershock activity associated with some historical ruptures in the province, it is difficult to associate recorded seismicity with specific faults. There are virtually no examples of foreshock activity preceding large earthquakes. For the most part, normal faults within the Great Basin seem to be aseismic and locked, but some may be close to the point of failure (US Geological Survey 2008b).

The proposed lease sites lie near the eastern base of the Warner Mountains. The Davis Creek fault, a late-quaternary fault, dissects the mountain range, crossing within one mile of the SWSW corner of Section 28 of CACA 043745.

## Impacts

### **Alternative A (No Action)**

The No Action alternative would have no impact on geological resources, and would not put any people or structures at risk from seismic-related events because no ground disturbing activities would be approved.

### **Alternative B (Proposed Action)**

The Proposed Action would not have any direct impacts on geological resources or put people or structures at risk from seismic events; however, the Proposed Action could have indirect impacts on these resources and result in indirect risks related to seismicity. Issuing leases for the pending lease sites could indirectly result in the development of geothermal resources at the sites, including increased human presence on the site, and construction of facilities, infrastructure and transmission lines.

Prior to construction of any facilities or infrastructure, geotechnical investigations would be required to ensure that any construction can withstand strong seismic events.

## 13.3.4 ENERGY AND MINERALS

### Setting

Electricity in rural Surprise Valley is provided by Pacific Power and Surprise Valley Electrification. Pacific Power is a subsidiary of PacifiCorp, which has more than 10,400 megawatts of generation capacity from coal, hydro, renewable wind power, gas-fired combustion turbines, solar and geothermal. Pacific Power serves approximately 43,850 square miles, and provides power over more than 58,000 miles of distribution lines (Pacific Power 2006).

Pacific Power generates or purchases power from four renewable energy facilities in Wyoming, Oregon, Idaho and Utah. PacifiCorp's 2007 Integrated Resource Plan calls for adding 1,400 megawatts of renewable energy to the power system in the next 10 years (PacifiCorp 2007). The IRP for Pacific Power is consistent with the State of California RPS, which aims to procure electricity from eligible renewable resources at a minimum 20% by 2017. In addition, Pacific Power operates Blue Sky Energy, a program which allows consumers to purchase wind energy in 100 kWh blocks for \$1.95 per increment per block per month (Pacific Power 2006).

The 1920 Mineral Leasing Act (as amended), the 1970 Geothermal Steam Act, and 43 CFR Parts 3100 and 3200 govern oil, gas, and geothermal leasing. Oil and gas exploration is encouraged under the Surprise FO Resource Management Plan and in the Modoc Resource Management Plan. Site-specific stipulations are included in any oil and gas or geothermal environmental assessment prior to the issuance of any lease. Upon receipt of a plan of development, site-specific surveys must be completed to eliminate or mitigate any adverse impacts (Bureau of Land Management 2007).

There are no existing oil and gas leases in the pending lease area. One 7,700 acre oil and gas lease exists on the Forest and five oil and gas leases totaling approximately 28,000 acres are pending (US Forest Service 1991). The BLM has identified prospective land for oil and gas development to the east of the leasing area, but all lands are considered to have low potential (Bureau of Land Management 2007).

The Surprise FO Resource Management Plan and Final EIS identifies the Lake City area as having the greatest potential in the FO for near-term geothermal development. Current development has been limited to low-level analysis of geothermal potential and no pending lease applications have currently been filed with the BLM. Future interest and activity is anticipated in the pending lease area. There is the potential for both indirect geothermal use for power production and direct geothermal use for agricultural and recreation purposes. Existing corridors are underutilized and would provide for energy development needs (Bureau of Land Management 2007).

The pending noncompetitive lease applications for CACA 043744 and 043745 were filed by Vulcan Power Corporation in 2001. The third pending noncompetitive lease application for proposed lease site CACA 042989 was filed by Lake City Geothermal LLC. Local Modoc NF staff indicated that one or two exploratory wells had already been drilled to the east of the NFS lands by Lake City Geothermal LLC, and that there is an intention to run power lines westward across the Forest Service lands (Biggerstaff 2008).

Exploration activities continue in the area to the east and north of proposed lease site CACA 042989 in attempts to characterize the extent of the Lake City

geothermal system. These efforts are centered on the Lake City Fault Zone, whose western edge, or “Range Front”, is roughly in line with the eastern boundary of proposed lease site CACA 042989 (Benoit et al. 2004). Between 2002 and 2005, three core holes were drilled at the Lake City geothermal field, the deeper two of which yielded temperatures of 327 and 327 degrees Fahrenheit (Benoit et al. 2005).

Potential locatable minerals in the leasing area include mercury, gold, silver, and zeolites, perlite, pumice and gemstones. Locatable mineral activity is primarily focused on areas of known mineral occurrences outside of the leasing area. In the Forest, mining has been confined to the Hayden Hill, Winters and High Grade mining districts. It is not anticipated that any new minerals will be found in large quantities within the Forest boundary, and mining of current mineral sources will fluctuate with the market price of the minerals (US Forest Service 1991). Saleable minerals such as sand, gravel and basalt landscaping stones have historically been sold to local communities. No gravel pits have been identified in the leasing area. On lands open to mineral development and exploration, restrictions may apply to protect natural resources and mitigate conflicts with management objectives and other land uses (US Forest Service 1991).

## Impacts

### ***Alternative A (No Action)***

The No Action alternative would have a minimal impact on energy and mineral resources, by not contributing to the local or State goals of increasing the development of renewable energy sources.

### ***Alternative B (Proposed Action)***

The Proposed Action would not have any direct impact on energy or mineral resources development, but would potentially result indirectly in the development of geothermal resources at the proposed lease sites. Under the RFD scenario, approximately two 20 MW plants for a total of 40 MW capacity is expected in the pending lease area. Impacts for a standard 50 MW plant are discussed in *Section 4.2.3 Energy and Minerals* in the PEIS. Similar impacts are anticipated in the pending lease area at a reduced scale. This indirect impact would allow existing geothermal resources in the area to be utilized and would contribute a renewable source of energy to the local and regional power grid. The Proposed Action could also potentially contribute to local and State efforts to meet the RPS as detailed under Senate Bill 1078. The subsequent geothermal development would also prevent other forms of energy or mineral development from taking place within the project footprint. All action would comply with stipulations provided by the BLM and FS plans.

### 13.3.5 SOIL RESOURCES

#### Setting

##### **CACA 043745**

This proposed site features some steep slopes with gentle terrain toward the top of the crest. Soil resources at the proposed site are a matrix of associations and gravelly, ashy loams. Paynepeak-Fendersflat south aspect association and Paynepeak gravelly ashy loam dominant the majority of the area. Both these soils derive from volcanic ash, colluvium, and residuum weathered from volcanic rock. Paynepeak-Fendersflat south aspect association has a slope of 15 to 50 percent; Paynepeak-Fendersflat gravelly ashy loam has a slope of four to 30 percent. Both soils have a depth of 40 to 60 inches, and are well drained, with no frequency of flooding, and a moderate available water capacity. The Supervisor-Cheadle families Rock outcrop association, Behanin-Cheadle families association, and Gallatin-Behanin deep-Duncom families complex soil types are found at the north end of the site. All three soil types are derived from weathered andesite, are well drained, and have very low to low available water capacity. Supervisory Cheadle families Rock outcrop association has a slope of 15 to 35 percent and a depth of more than 80 inches. The Behanin-Cheadle families association has a slope of 35 to 55 percent, with a depth of more than 80 inches. The Gallatin-Behanin deep-Duncom families complex has a slope of 35 to 60 percent, with a depth of more than 80 inches. Warnermount-Crazybird association, a soil derived from volcanic ash and rock, is found in the site's southern region. Slope for this soil type is typically 15-50 percent, with a depth of 20 to 39 inches. The soil is well drained with a low available water capacity (Natural Resources Conservation Service 2008).

##### **CACA 043744**

This proposed site features a steep and unstable matrix of gravelly loams, Paynepeak-Fendersflat associations, and Warnermount-Crazybird association. These soil types are derived from volcanic ash and colluvium. Both Paynepeak-Fendersflat cool association and Paynepeak-Fendersflat south aspect association have a slope of 15 to 50 percent, with a depth of 40 to 60 inches. These soils are well drained, with no frequency of flooding, and a moderately available water capacity. Warnermount-Crazybird association soil is found at steeper slopes, and has low available water capacity. This soil type is discussed in greater detail below (see CACA 043745). Gravelly loams found at the proposed site have an average slope of 30-50 percent, are well drained, and have very low to moderate water capacity (Natural Resources Conservation Service 2008).

##### **CACA 042989**

This proposed site features steep and unstable soils dominated by Crazybird-Warnermount association, a soil derived from volcanic ash, colluvium from pyroclastic rock, and residuum weathered from pyroclastic rock. Slope of this soil type is generally 30 to 50 percent, with a depth of 14-20 inches to paralithic

bedrock. The soil is well drained, with no frequency of flooding. Water capacity is very low. Warnermount-Crazybird association, a soil derived from volcanic ash and rock, is found along the western edge of the site (see CACA 043745 for description) (Natural Resources Conservation Service 2008).

There are no prime or unique farmlands at any of the proposed lease sites (Natural Resources Conservation Service 2008).

## Impacts

### **Alternative A (No Action)**

The No Action alternative would have no impact on soil resources because no ground disturbing activities would be approved.

### **Alternative B (Proposed Action)**

The Proposed Action would not have any direct impact on soils, but would potentially result in indirect impacts on erosion related to ground disturbance from the geothermal exploration and development process. Erosion impacts would be greater in the two proposed eastern sites that contain steep slopes and unstable soils.

Prior to construction of any facilities or infrastructure, geotechnical investigations would need to be conducted to ensure that any construction be situated on stable soils, and that erosion-prevention measures be implemented in accordance with permitting requirements. Any disturbance of greater than one acre would require a General Construction Stormwater Permit from the State Water Resources Control Board, and as part of that permit application, a Stormwater Pollution Prevention Plan would be submitted. The Plan would describe erosion-prevention measures that would be incorporated into project plans. Additional mitigation may be determined at the notice of staking or the application for permit to drill stage.

## 13.3.6 WATER RESOURCES AND QUALITY

### Setting

#### **Surface Water**

Annual average precipitation in the lease area is about 13 inches (Western Regional Climate Center 2008). The pending lease area is within the Surprise Valley Hydrologic Unit. Water quality in this unit is managed by the Lahontan Regional Water Quality Control Board. Surface waters in the pending lease area are limited to several creeks, namely Powley, Wilkinson, Mill, and two tributaries of the South Fork of Davis Creek. Powley, Wilkinson, Mill, and Boyd creeks drain to Surprise Valley to the east, while the tributaries of South Fork of Davis Creek drain to the west.

Mill Creek is the largest of the creeks draining to Surprise Valley at Lake City. The following beneficial uses are recorded for Mill Creek:

- MUN – Municipal and Domestic Supply
- AGR – Agricultural Supply
- GWR – Groundwater Recharge
- FRSH – Freshwater Replenishment
- REC-I – Non-contact Water Recreation
- COMM – Commercial and Sports Fishing
- COLD – Cold Freshwater Habitat
- WILD – Wildlife Habitat
- SPWN – Spawning, Reproduction and Development

Mill Creek exceeded water quality objectives set out in the Lahontan Water Quality Control Plan for Total Dissolved Solids every year from 2001 through 2005 (no data available after 2005). In 2005, for the first time, Mill Creek was measured to have dissolved oxygen levels lower than the acceptable one-day minimum, and exceeded acceptable fecal coliform levels on three sample events out of seven during the period from September 2003 through July 2005 (Lahontan Regional Water Quality Control Board 2008).

The South Fork of Davis Creek flows to the northwest into the Goose Lake Basin, and then north to Goose Lake. Water quality in the Goose Lake Basin is managed by the Central Valley Regional Water Quality Control Board. The Goose Lake Basin has been identified as a Category I Priority Watershed in the California Unified Watershed Assessment. The perennial streams of the Basin are reported to be degraded. Temperature and sediment are the principal water quality impairments in most of the tributaries of the Basin. Landowners and conservation groups in the area are making efforts to improve the quality of the basin's tributary streams for the variety of beneficial uses that come from these waters (Goose Lake Resource Conservation District 2002).

#### **Ground Water**

The proposed lease site lies within the Surprise Valley groundwater basin. Surprise Valley is a complexly faulted graben filled with alluvial and lacustrine sediments, and bounded on all sides by block-faulted structures. Water is stored in Holocene alluvium and alluvial fan deposits, Pleistocene near-shore deposits, and Pliocene to Pleistocene lake deposits. The basin is approximately 50 miles long and 12 miles wide, and closed with no hydrologic outlet. Most of the streams draining into Surprise Valley originate along the eastern slopes of the Warner Mountains and empty into the Upper, Middle, and Lower Alkali lakes. These lakes are shallow, alkaline, and usually become dry in summer months.

Annual precipitation in the basin ranges from 13-17 inches, increasing in the north. While groundwater level trends are unknown, groundwater storage capacity to a depth of 400 feet is estimated to be approximately four million acre-feet. Natural recharge to the basin is from infiltration of surface water into alluvial fans at the base of the Warner Mountains. In the extreme northern portion of the valley, surface water from the north infiltrates coarse stream deposits and recharges underlying groundwater bodies. No true upland recharge areas exist along the western and northern sides of the valley (California Department of Water Resources 2003).

Poor water quality is present in areas near Upper and Middle Alkali lakes due to high levels of alkaline compounds and dissolved solids. Most wells in the area are used for irrigation purposes (California Department of Water Resources 2003).

## Impacts

### ***Alternative A (No Action)***

The No Action alternative would have no direct or indirect impact on water resources and quality because no ground disturbing activities would be approved.

### ***Alternative B (Proposed Action)***

#### *Surface Waters*

The proposed action would have no direct impact on surface water quantity or quality, but could result in indirect impacts should geothermal exploration and development occur. Mill Creek can be considered an impaired water body in terms of total dissolved solids and fecal coliforms, and could be further degraded by any stormwater runoff generated by development activities within the southern portions of proposed lease sites CACA 043744 and 043745. Water quality in the tributaries of Davis Creek in the northern portion of CACA 043745 could also be negatively affected by ground disturbance.

Lease stipulations addressing stormwater are included in Appendix B of the PEIS and would reduce impacts to surface water quality. Additionally, any disturbance of greater than one acre would require a General Construction Stormwater Permit from the State Water Resources Control Board, and as part of that permit application, a Stormwater Pollution Prevention Plan would be submitted. The Plan would describe erosion-prevention measures that would be incorporated into project plans to reduce polluted stormwater from affecting nearby waterways.

#### *Groundwater*

The proposed action would have no direct impact on groundwater levels or quality, but could result in indirect impacts should geothermal exploration and development occur. General impacts to groundwater are described in Chapter 4 of the PEIS. Groundwater resources are not reported to be currently

impaired or insufficient to meet local needs. No impacts to groundwater quantity or quality would be expected; however impacts could occur if the geothermal reservoir is connected to the water table aquifer.

### 13.3.7 AIR QUALITY AND CLIMATE

#### Setting

The pending lease area is located in Modoc County, an area with air quality status of Unclassified. Due to the remote location of the proposed lease sites, air quality is considered to be good.

The lease area lies within the Great Basin. The Great Basin extends from Utah to the Sierra Nevada and has no surface drainage to the ocean. It is an area of climatological extremes. The principal climatic features of the lease area are bright sunshine, small annual precipitation, (averaging 13 inches per year), clean, dry air, and exceptionally large daily ranges of temperature. The closest weather monitoring station to the lease site is in Cedarville. Average maximum temperatures in Cedarville range from 39.9 degrees Fahrenheit in January, to 87.3 in July, with average minimum temperatures ranging from 20.4 degrees Fahrenheit in January, to 54.8 in July (Western Regional Climate Center 2008).

#### Impacts

##### **Alternative A (No Action)**

The No Action alternative would have no impact on air quality or climate because no ground disturbing activities would be approved.

##### **Alternative B (Proposed Action)**

The Proposed Action alternative would not result in violations of ambient air quality standards given the Unclassified status of the county and the good air quality. The proposed action would have no direct impact on air quality or climate, but could result in minor indirect impacts should geothermal exploration and development occur. For example, a short-term minor impact from dust and diesel exhaust during construction is to be expected.

### 13.3.8 VEGETATION

#### Setting

There are three proposed lease sites, which occur on NFS and public lands. The proposed lease sites are located within the Modoc Plateau ecological section and within the Warner Mountains subsection. Lands within the pending lease area rise from approximately 4,000 feet elevation to 7,500 feet. The natural plant communities in the pending lease area are dominated by ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*Pinus jeffreyi*), mixed conifer, and lodgepole pine (*Pinus contorta*) stands, interspersed with western juniper (*Juniper occidentalis*), sagebrush (*Artemisia* spp.), bitterbush (*Purshia tridentate*); and aspen

(*Populus tremuloides*) and willow (*Salix* spp.) stringers in disturbed and riparian areas. Mountain meadows are also present in the lease sites, consisting of open areas covered with grasses and forbs, as well as small aspen groves. The eastern side of the pending lease area is steep and soils are unstable. The western edge of the pending lease area is more gently sloping. Activities that affect vegetation such as limited timber harvest and recreational activities (hunting, hiking, fishing) appear or have occurred within the pending lease area (Flores and Carlock 2008).

### **Invasive Species**

Invasive species include any type of species that are not native to that ecosystem and includes plants or animals that have been introduced into an environment where they did not evolve (Bureau of Land Management 1998). Invasive species can have dramatic impacts on the natural ecosystem by reducing habitat for native vegetation as well as from altering forage and wildlife habitat. Invasive species reduce the productivity of healthy rangelands, forestlands, riparian areas, and wetlands. Eradication of these species is intensive, time consuming, and costly.

In California, it is estimated that 3 percent of plant species growing in the wild are considered invasive species. Numerous exotic grasses and plants, like perennial pepper weed (*Lepidium latifolium*), annual medusahead (*Taeniatherum caput-medusa*), red brome (*Bromus rubens*), and various non-native thistles, have displaced native plants and altered local plant communities on the Modoc Plateau (California Department of Fish and Game 2006). Cheatgrass (*Bromus tectorum*) has had a particularly dramatic impact on native shrub and grassland communities of the Great Basin and the lower elevations of the Warner Mountains. These communities are limited throughout the pending lease area, but do exist at lower elevations. Cheatgrass displaces native grasses and forbs by more effectively tapping soil moisture and hinders seedling establishment of native shrubs by reducing moisture and nutrients in surface soils (Norton et al. 2004).

### **Wetlands/Riparian Areas**

No wetlands are found within the pending lease area (US Forest Service 2008b). Several small intermittent streams run east from the Warner Mountains to Upper Lake, passing through the north and central portion of the pending lease area. These streams include Pauly and Wilkinson Creek. Mill Creek, which passes through the southern section of the project, is a perennial stream and supports riparian vegetation as well as a seasonal trout fishery. The riparian areas are typically populated with aspens and willows. Aspen stands are in sharp decline throughout the Modoc National Forest (Di Orio et al. 2005).

### **Riparian Reserves**

On federal lands, riparian reserves are designated to protect water quality; timber harvest is prohibited and ground disturbances are not allowed. The

reserve's width is based on the presence of fish and whether the stream is permanent or intermittent.

### **Special Status Species**

There are several special status species that are known to occur or may potentially occur within the vicinity of the pending lease area. Special status species include Federally-listed endangered, threatened, proposed, and candidate plant species, California State-listed endangered, threatened, and rare plant species, and BLM and FS sensitive plant species. See Section 3.11, Threatened and Endangered Species and Special Status Species, for discussion of these species.

### **Impacts**

Leasing of geothermal resources does not directly affect vegetation or important habitats and communities. Vegetation would be affected only by subsequent development of geothermal resources. Impacts are associated with the elimination and degradation of habitat occurring either as the result of future development in the pending lease area or in the areas immediately adjacent.

Potential impacts on vegetation and important habitats could occur if reasonably foreseeable future actions were to result in the following:

- Affect a plant species, habitat, or natural community recognized for ecological, scientific, recreational, or commercial importance;
- Affect a species, habitat, or natural community that is specifically recognized as biologically significant in local, state, or federal policies, statutes or regulations;
- Establish or increase of noxious weed populations;
- Destroy or extensively alter habitats or vegetation communities in such a way that would render them unfavorable to native species; and/or
- Conflicts with BLM or FS management strategies.

### **Alternative A (No Action)**

The No Action alternative would have no impact on vegetation or important habitats because no ground disturbing activities would be approved.

**Alternative B (Proposed Action)**

The Proposed Action would not have any direct impact on vegetation, but would potentially result in indirect impacts to vegetation from subsequent geothermal development activities. Geothermal development can cause the following stressors which may result in associated indirect impacts to vegetation and important habitats:

- Habitat disturbance – Site clearing, well drilling, construction of access roads and geothermal facilities, as well as maintenance and operational activities would disturb habitat which in turn could cause mortality and/or injury to plants, an increased risk of invasive species colonization, alter water and seed dispersion, as well as affect wildlife use, which can further affect vegetation communities.
- Direct Removal and Injury – Vegetation would be cleared for roadways, vehicle staging, buildings, pipelines, and transmission lines. These activities could result in loss of soil, loss of seed bank in soil, deposition of dust, and destruction of biological soil crusts. Maintenance around project components, such as drill pads, buildings, pipelines, or other facilities, would involve mowing, herbicide treatment, and other mechanical or chemical means of removal and control of plant life. This would in turn result in a net loss of important habitats and communities throughout the planning area.
- Invasive Vegetation – Disturbance and access by vehicles and human foot traffic may expose areas to colonization by invasive and non-native species, making it more difficult for endemic species to reestablish in disturbed areas as well as threatening the continued existence of endemic species (Bureau of Land Management 2007).
- Fire – Increased vehicular and human traffic, operation of equipment, the use of drilling muds, and the extraction of geothermal fluids can increase the risk of fires. Vehicles, electrical lines, and cigarette smoking can all result in accidental fires. Fires destroy vegetation and can aid in the establishment of invasive species.
- Erosion – Site clearing, grading, construction of access roads, containment basins, site runoff, and vehicle and human foot traffic cause erosion. The effects of erosion include the removal of top soil, loss of seed bank, loss of native vegetation, the establishment of invasive species, the sedimentation of streams, and flooding (which can directly result in effects to riparian vegetation and riparian habitats).
- Exposure to Contaminants – Vehicle fuel, hydraulic fluid, solvents, cleaners, and geothermal fluids can all be harmful to vegetation and

important habitats. Accidental spills can contaminate soils and water and directly harm vegetation. Licensed herbicide use would likely be used to control vegetation around geothermal facilities and support structures. Spills of herbicides or acute exposure to herbicides can have adverse effects on non-target vegetation.

Table 3.9-1 in section 3.9 of the PEIS provides an analysis of the likelihood for impacts to occur during each phase of geothermal development (exploration, drilling operations, utilization, and reclamation and abandonment).

#### *Riparian and Wetland Habitat*

The riparian habitat and intermittent stream drainages, as well as Mill Creek, may be affected by activities associated with all phases of geothermal projects if development were to occur in close proximity to these habitats. Chapter 4 of the PEIS provides more specific detail on the impacts to riparian and wetland habitats associated with geothermal development activities. Wetlands are not currently present in the pending lease area, but wetland conditions are subject to change based on precipitation and other ecological and geologic events that may affect hydrology. Impacts to wetlands are regulated under the River and Harbors Act and Section 404 of the Clean Water Act. Permitting from the US Army Corps of Engineers (Corps) would be required if future development at the site would have any impact to wetlands under Corps' jurisdiction. In addition, E.O. 11990, "Protection of Wetlands," requires all federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. DOE implementation of this E.O. is included in 10 CFR 1022.

### 13.3.9 FISH AND WILDLIFE

#### Setting

There are 399 vertebrate species that inhabit the Modoc Plateau region at some point in their life cycle, including 235 birds, 97 mammals, 23 reptiles, 6 amphibians, and 38 fish (California Department of Fish and Game 2006).

Common mammal species include mule deer (*Odocoileus hemionus*), rabbits, squirrels, porcupine (*Erethizon dorsatum*), chipmunks, coyote (*Canis latrans*), badger (*Taxidea taxus*), and bobcats (*Lynx rufus*). There are documented Sierra Nevada red fox (*Vulpes vulpes nescator*) sightings in the western portion of the pending lease area. Porcupine (*Erethizon dorsatum*) and marten (*Martes americana*) may also be present in the lease area.

Bird species include various quail, dove, woodpeckers, warblers, sapsuckers, flycatchers, owls, and red-tailed hawk (*Buteo jamaicensis*). Golden eagles (*Aquila chrysaetos*), peregrine (*Falco peregrinus*), prairie falcons (*Falco mexicanus*), and

northern goshawks (*Accipiter gentiles*) hunt in the pending lease area. Numerous waterfowl of the Pacific Flyway pass through and may nest in the area.

A variety of reptiles utilize the project area, including the California king snake (*Lampropeltis getula californiae*), western rattlesnake (*Crotalus oreganus*) the Pacific gopher snake (*Pituophis catenifer catenifer*), terrestrial garter snake (*Thamnophis elegans*), alligator lizard (*Elgaria coerulea*), and western skink (*Eumeces skiltonianus*). The streams in the pending lease area are predominately intermittent, with the exception of Mill Creek, and are not known to support fisheries (US Forest Service 2008b). Mill Creek supports rainbow trout from historical stocking efforts, but does not contain any special status fish species (US Environmental Protection Agency 2004, US Forest Service 2008b)

The major stressors negatively affecting terrestrial wildlife on the Modoc Plateau are a combination of livestock and feral horse grazing, invasive annual grasses, the expansion of native western juniper, and altered frequencies of fire. Together, these stressors have combined to alter the region's sagebrush and forest habitats and ecosystems (Miller et al. 1994, Schaeffer et al. 2002).

### Impacts

Leasing of geothermal resources does not directly affect fish and wildlife. Fish and wildlife would be affected only by subsequent development of geothermal resources on the proposed lease sites. Impacts were assessed based on typical actions and disturbance associated with geothermal development activities. Potential impacts on fish and wildlife species could occur if reasonably foreseeable future actions were to result in the following:

- Adversely affect a population by substantially reducing its numbers, causing a fish or wildlife population to drop below self sustaining levels, or by causing a substantial loss or disturbance to habitat utilized by a fish or wildlife population. Examples of such habitat effects could include vehicle impacts and crushing, increased predation, habitat fragmentation, or loss of seasonal habitat;
- Have a substantial adverse impact on nesting migratory birds, including migratory raptors, as protected under the Migratory Bird Treaty Act;
- Interfere with the movement of any resident or migratory fish or wildlife species, or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites; and/or
- Conflict with the wildlife management strategies of the BLM or FS.

**Alternative A (No Action)**

The No Action alternative would have no impact on fish and wildlife because no ground disturbing activities would be approved.

**Alternative B (Proposed Action)**

The Proposed Action would not have any direct impact on fish and wildlife, but would potentially result in indirect impacts to fish and wildlife from geothermal development activities.

Fish and aquatic wildlife would be at minimal risk of being affected from geothermal activities on the proposed lease sites. Mill Creek is the only year-around waterway and the steep topography in its watershed would make development unlikely. Potential impacts to waterways and fish and aquatic life would be analyzed prior to any ground disturbing activities.

Terrestrial wildlife species could be displaced during the removal of habitat or development of geothermal facilities. Small ground dwelling species such as reptiles and small mammals could also be crushed by vehicle traffic and clearing activities. Fire can also cause direct mortality. Vehicles, cigarette smoking, and power lines can cause wildfires that can kill and displace animal species, especially smaller and less mobile animals. Invasive vegetation introduced during exploration and development activities can also alter wildlife habitat, making it less suitable for habitation.

The habitats within the pending lease area provides important habitat for a variety of resident and migratory birds. The FS and BLM area required to analyze the impacts of any action on migratory birds, under the Migratory Bird Treaty Act. The likelihood of disturbing nests of such birds is limited primarily to breeding and nesting seasons (spring and summer). Lease stipulations to avoid disturbance during the migratory bird nesting season, so as not to violate the Migratory Bird Treaty Act, would reduce the potential for significant impacts on migratory birds. Waterfowl, raptors, and small birds that depend on particular forest types as a source of food or cover could be vulnerable to loss of these habitats within the pending lease area. In addition, removing timber and other vegetative cover is likely to affect foraging and nesting behavior.

### 13.3.10 THREATENED AND ENDANGERED SPECIES AND SPECIAL STATUS SPECIES

#### Setting

This section provides an overview of threatened, endangered, and special status species, and their habitats that may occur in the pending lease area. Special status species are those identified by federal or state agencies as needing additional management considerations or protection. Federal species are those protected under the Endangered Species Act and those that are candidates or proposed for listing under the Endangered Species Act. State sensitive species

are those considered sensitive by the California Department of Fish and Game. A list of Sensitive species that may occur in the pending lease area is provided below based on a search of the California Natural Diversity Database, correspondence with Modoc National Forest biologists, other documents as referenced, and understanding of the local habitat. Table 13.3-1 below lists species known to occur in the greater project area. There are no known Federally-listed special status species in the pending lease area.

### Impacts

Potential impacts on threatened and endangered and special status species could occur if reasonably foreseeable future actions were to:

- Violate the Endangered Species Act, Migratory Bird Treaty Act, or applicable state laws; and/or
- Decrease a plant or wildlife species population to below self-sustaining levels.

#### ***Alternative A (No Action)***

The No Action alternative would have no impact on special status species because no ground disturbing activities would be approved.

#### ***Alternative B (Proposed Action)***

The Proposed Action would not have any direct impact on special status species, but would potentially result in indirect impacts to special status species as the result of future geothermal activities. Threatened and endangered species (including federal and state listed species and FS and BLM special status species) could be affected as a result of (1) habitat disturbance, (2) the introduction of invasive vegetation, (3) injury or mortality, (4) erosion and runoff, (5) fugitive dust, (6) noise, (7) exposure to contaminants, and (8) interference with behavioral activities.

Because of the regulatory requirements of the Endangered Species Act and various state regulations, the requirements specified in BLM Manual 6840 Special Status Species Management, and other resource-specific regulations and guidelines, any future geothermal activities would incorporate appropriate survey, avoidance, and mitigation measures. These measures would be identified and implemented prior to any geothermal activities in order to avoid adversely affecting any sensitive species or the habitats on which they rely.

**Table 13.3-1  
Threatened and Endangered Species and Special Status Species Known to Occur in  
the Modoc National Forest**

Scientific Name	Common Name	Status
		Federal <sup>1</sup> /State <sup>2</sup> /CNPPS <sup>3</sup> / USFS
<b>PLANTS</b>		
<i>Botrychium crenulatum</i>	Scalloped moonwort	--/--/2.2
<i>Botrychium lunaria</i>	Common moonwort	--/--/2.3
<i>Botrychium montanum</i>	Western goblin	--/--/2.1
<i>Botrychium pinnatum</i>	Northwestern moonwort	--/--/2.3
<i>Dimeresia howellii</i>	Doublet	--/--/2.3
<i>Lomatium grayi</i>	Gray's lomatium	--/--/2.3
<i>Mertensia oblongifolia</i> var. <i>amoena</i>	Beautiful sagebrush bluebells	--/--/2.2
<i>Mimulus evanescens</i>	Ephemeral monkeyflower	--/--/1.B2
<i>Silene oregana</i>	Oregon campion	--/--/2.3
<i>Synthyris missurica</i> ssp. <i>missurica</i>	Kitten-tails	--/--/2.3
<b>BIRDS</b>		
<i>Accipiter gentilis</i>	Northern goshawk	--/--/--/S
<i>Aquila chrysaetos</i>	Golden eagle	--/SC/--/S
<i>Buteo regalis</i>	Swainson's hawk	--/SC/--/S
<i>Falco mexicanus</i>	Prairie Falcon	--/--/--/S
<i>Grus canadensis tabida</i>	Greater sandhill crane	--/ST/--
<b>MAMMALS</b>		
<i>Antrozous pallidus</i>	Pallid Bat	--/SC/--/S
<i>Corynorhinus townsendii</i>	Townsend's big eared bat	--/SC/--/S
<i>Martes americana</i>	American marten	--/--/--/S
<i>Vulpes vulpes necator</i>	Sierra Nevada red fox	--/ST/--

<sup>1</sup>Federal status:

FE = Endangered under the Endangered Species Act

FT = Threatened under the ESA

SOC = Species of concern

<sup>2</sup>California state status

SE = State Endangered; critically imperiled due to extreme rarity, imminent threats, and or biological factors

ST = State Threatened; Imperiled due to rarity and/or other demonstrable factors

SC = State species of concern; apparently secure, though frequently quite rare in parts of its range, especially at its periphery

<sup>3</sup>California Native Plant Society

1B.2 = Plants rare, threatened, or endangered in California and elsewhere: fairly threatened in California

2.1 = Plants rare, threatened, or endangered in California, but more common elsewhere: seriously threatened in California

2.2 = Plants rare, threatened, or endangered in California, but more common elsewhere: fairly threatened in California

2.3 = Plants rare, threatened, or endangered in California, but more common elsewhere: not very threatened in California

Source: California Natural Diversity Database 2008, Bureau of Land Management 2003

### 13.3.11 LIVESTOCK GRAZING

#### Setting

Three grazing allotments overlap the entire lease area. Table 13.3-2 shows the acreages of each grazing allotment within each pending lease site.

**Table 13.3-2  
Acreages of Grazing Allotments in the Proposed Lease Areas**

Lease	Grazing Allotment		
	Bald Mountain	Davis Creek	Lassen Creek
CACA 042989	0	0	250
CACA 043744	1,200	160	1,100
CACA 043745	1,200	1,200	70

#### Impacts

##### **Alternative A (No Action)**

The No Action alternative would have no direct or indirect impact on livestock grazing because no ground disturbing activities would be approved.

##### **Alternative B (Proposed Action)**

The Proposed Action would not have any direct impact on livestock grazing, but would potentially result in indirect impacts to livestock as the result of future geothermal activities. Indirect impacts would include loss of forage, reduced forage palatability because of dust on vegetation, and displacement of livestock from construction noise. Additional roads could also impact livestock by opening up areas that were not previously accessible, thereby increasing disturbance or harassment of livestock. However, creating new access roads to areas where livestock graze would help livestock operators manage their stock more efficiently.

Because of the large proportion of the lease sites being in Inventoried Roadless Areas, and the steep topography that is not suitable for grazing, impacts to livestock grazing are anticipated to be minimal.

### 13.3.12 CULTURAL RESOURCES

#### Setting

Cultural resources are past and present expressions of human culture and history in the physical environment and include prehistoric and historic archaeological sites, structures, natural features, and biota that are considered important to a culture, subculture, or community. Cultural resources also include aspects of the physical environment that are a part of traditional lifeways and practices and are associated with community values and institutions.

As in Volume I of the PEIS, discussions relevant to cultural resources in this document are found in three sections. Traditional cultural resources and traditional cultural properties are addressed in Section 13.3.13, *Tribal Interests and Traditional Cultural Resources*. Section 13.3.14 addresses *Historic and Scenic Trails*. Cultural resources in this section include the physical remains of prehistoric and historic cultures and activities.

The lease sites are within an archaeologically sensitive area of the western extreme of the Great Basin culture region as described in Appendix I of Volume III of the PEIS. The most prevalent cultural resource sites in the Surprise Valley area are associated with historic-era ranching and farming (Bureau of Land Management 2007). The peaks of the Warner Range, in which the leases sites are located, are the designated separation between the Great Basin and California culture regions. Cultural aspects of both regions likely existed within the lease areas. Within the Great Basin culture region, the Modoc NF/Surprise FO leases application sites are within the traditional territory of the Northern Paiute; however, the western boundary of this territory is at the peak ridgeline of the Warner Range. West of the range peaks is the traditional territory of the Achumawi of the California culture region. The area likely experienced influences from and occupations by both groups over time. Bengston (2003) provides a comprehensive ethnographic overview of the Northern Paiute. The following discussion is based primarily on that overview.

The earliest people to inhabit this area are referred to as Paleoindian and Archaic cultures (Gates 2008). Little is known about these groups. Bengston places the project area near the extreme western territorial boundary of the Northern Paiute. Comprised of individual bands, the majority of Northern Paiute territory is in Nevada (Bengston 2003). It is believed that the Northern Paiute entered the Great Basin approximately 1,000 – 5,000 years ago, most likely from the west. The Northern Paiute remained in the area and was one of the Native American groups encountered by historic European explorers. The prehistoric group is categorized as a fishing, hunting, and gathering group, subsisting on plant gathering, hunting of game, and fishing via traps, weirs, and nets in rivers and lakes. They were semi-nomadic moving across the landscape in seasonal rounds, utilizing temporary and easily-constructed structures. Winter camps were established typically near pinyon caches and temporary camps were established throughout territorial areas for the purposes of hunting and gathering (Bengston 2003). In the Surprise Valley area, winter camps were typically situated on the valley floor while base camps for resource exploitation activities during the summer were established in upland areas (Bureau of Land Management 2007). The Warner Mountain Range has been identified as an area of plant collection for local Northern Paiute and Pit River peoples (Bengston 2003; Gates 2008).

A variety of historic-era activities have been documented within the region of the proposed project. These included fur trapping during an initial period of

Euro-American exploration, emigration and settlement by Euro-Americans, establishment of roads and trails, and mining. Fur-trapping potential was always marginal in the Great Basin, and expeditions ended in the early 1840s. As fur trapping declined, official government mapping and exploration expeditions were expanded into the Great Basin, partially to establish an American presence in what was, until 1848, Mexican territory. Later, several trails were established by emigrants, most passing through the region on their way to California during the Gold Rush (Bengston 2003). The most often used route to the California goldfields, the Applegate and Lassen Trail segments of the California National Historic Trail, entered California in Surprise Valley immediately east of the project area and continued on over Fandango Pass (Bureau of Land Management 2008). The first significant Euro-American incursions into the Surprise Valley area occurred in 1864 (Gates 2008) when drought in the Central Valley forced many cattle ranchers to relocate to northeast California where there was available grass and open range. Sheep and cattle ranching eventually became the dominate economy of the Surprise Valley area. Livestock would graze in the higher elevations and forested areas while hay was grown on the valley floor. Other historic economic activities of the area include logging, dairies, blacksmith shops, and other commercial interests, including a brief foray into mining (Bureau of Land Management 2007).

Data on cultural resources of the proposed lease areas were provided in April 2008 by Gerry Gates, Heritage Resource Program Manager for the Modoc National Forest and in May by the Northeast Information Center (NEIC) of the California Historic Resources Information System (NEIC File No. D08-29). The basic records search conducted by Mr. Gates revealed 25 previously recorded cultural resources within CACA 043745, two within CACA 043744, and none within CACA 042989. The NEIC records search covered non-FS lands within CACA 042989 and revealed one resource partially within the lease area and one additional site within one mile of the lease. Only the northern portion of CACA 043745 has had significant survey coverage for cultural resources. The rest of the Modoc lease areas have had limited to no survey coverage. Mr. Gates notes that level ground within the three lease areas, including ridge tops, benches, and terraces adjacent to drainages, is considered highly sensitive for previously undocumented cultural resources. Additionally, it is predicted that 30 to 50 more prehistoric archaeological sites are located within the unsurveyed portions of the lease areas (Gates 2008).

The majority of cultural resources within CACA 043745 are prehistoric. Nineteen lithic scatters have been identified, none of which have been previously evaluated for National Register of Historic Places (NRHP) eligibility and are therefore treated as eligible. Additionally, one quarry, one prayer seat, and one hunting blind all with associated lithic scatters have been identified within the lease area and are unevaluated. One other unevaluated hunting blind been identified as well. The large NRHP-eligible Buck Mountain ("Headwaters") Obsidian Source/Quarry Workshop is also within the northern portion of the

lease area. The boundaries of this site have not yet been verified. There is one single unevaluated historic site within the CACA 043745 as well. Table 13.3-3 summarizes the cultural resources within Lease CACA043745. Only the northern portion of the lease has been extensively surveyed for cultural resources.

Both cultural resources within CACA 043744 are prehistoric. One is a lithic scatter, FS Site No. FS-05-09-53-0133 (CA-Mod-1099), that has not been evaluated for NRHP eligibility. The second resource is the NRHP-eligible Buck Mountain (“Headwaters”) Obsidian Source/Quarry Workshop, FS Site No. FS-05-09-53-0426 (CA-Mod-2373). This resource extends into CACA 043744 from CACA 043745 to the west, however its boundaries are not yet confirmed. Very little (less than 10%) of the lease application site has been previously surveyed for cultural resources.

No cultural resources were identified on FS lands within Lease CACA 04298 by Mr. Gates’ records. The NEIC records search identified a portion of one prehistoric resource, CA-Mod-5891, on private lands within the lease and one additional site, CA-Mod-216, an obsidian source and possible quarry, as within one mile of the lease. The northwestern-most portion of CA-Mod-5891, a large lithic and groundstone scatter, extends into the CACA 04298 lease area. The site is considered an village site with loci of activity most often occurring on ridges and knolls and around hot springs. Furthermore, this site may correspond to an ethnographic Northern Paiute village (Northeast Information Center 2008). This site is considered eligible for the NRHP. None of the lease area, NFS lands or private lands, has been previously surveyed.

Consultation with federally recognized tribes that are affiliated with the lease area was initiated on September 12, 2007 to identify and assess historic properties that may be affected by the undertaking. No responses from local tribes have been received as of the date of publication, however consultation is considered on-going.

**Table 13.3-3  
Archaeological Sites within CACA 043745**

<b>FS Site No.</b>	<b>Trinomial</b>	<b>Description</b>	<b>FS Site No.</b>	<b>Trinomial</b>	<b>Description</b>
FS-05-09-53-0133	CA-Mod-1099	Lithic Scatter	FS-05-09-53-0986	CA-Mod-3204	Lithic Scatter
FS-05-09-53-0413	CA-Mod-3189	Lithic Scatter/Quarry	FS-05-09-53-0987	CA-Mod-3205	Lithic Scatter
FS-05-09-53-0426	CA-Mod-2373	Buck Mtn. Obsidian Source	FS-05-09-53-0988	N/A	Lithic Scatter
FS-05-09-53-0602	CA-Mod-4444	Lithic Scatter	FS-05-09-53-0989	N/A	Lithic Scatter
FS-05-09-53-0668	CA-Mod-4445	Lithic Scatter	FS-05-09-53-0992	CA-Mod-3206	Hunting Blind
FS-05-09-53-0828	CA-Mod-3190	Lithic Scatter	FS-05-09-53-1017	CA-Mod-3207	Lithic Scatter
FS-05-09-53-0957	CA-Mod-3194	Lithic Scatter	FS-05-09-53-1110H	CA-Mod-4443H	Historic
FS-05-09-53-0974	CA-Mod-3198	Lithic Scatter	FS-05-09-53-1175	N/A	Lithic Scatter
FS-05-09-53-0975	CA-Mod-3199	Lithic Scatter	FS-05-09-53-1179	CA-Mod-4446	Lithic Scatter
FS-05-09-53-0982	CA-Mod-3200	Lithic Scatter	FS-05-09-53-1181	CA-Mod-4447	Lithic Scatter/Hunting Blind
FS-05-09-53-0983	CA-Mod-3201	Lithic Scatter	FS-05-09-53-1182	CA-Mod-4448	Lithic Scatter
FS-05-09-53-0984	CA-Mod-3202	Lithic Scatter/Prayer Seat	FS-05-09-53-1195	CA-Mod-4449	Lithic Scatter
FS-05-09-53-0985	CA-Mod-3203	Lithic Scatter			

Until consultation with local Native Americans has been completed, it is unknown if there are Native American sites or sacred sites within or adjacent to the lease application sites. The presence of cultural resources within portions of the leases not previously surveyed is also possible. Table 13.3-4 summarizes available data on the cultural resources of the lease application sites.

**Table 13.3-4  
Cultural Resources in the Proposed Lease Areas**

Lease CACA	Surveys (Percent)	NRHP- listed sites	NRHP- eligible sites	NRHP- ineligible sites	Unevaluated sites (Treated as NRHP- Eligible)
042989	0%	N/A	I	N/A	N/A
043744	<10%	N/A	I	N/A	I
043745	40-50%	N/A	I	N/A	24

### Impacts

#### **Alternative A (No Action)**

The No Action alternative would have no impact on cultural resources.

#### **Alternative B (Proposed Action)**

Completion of the Section 106 process of the National Historic Preservation Act requires the BLM and FS to consult with the State Historic Preservation Office, tribes and other parties to identify and assess historic properties affected by the undertaking and develop measures to avoid, minimize, or mitigate any adverse effects of the undertaking on historic properties. Since ground disturbing activities would not occur until permits for phases of geothermal development are issued, direct impacts on cultural resources resulting from the issuance of the lease would not occur.

Given the density of sites within the region, the presence of NRHP-listed and -eligible resources, and the general lack of survey coverage within the Modoc area leases, indirect and secondary impacts on cultural resources could occur from subsequent permitted geothermal exploration, drilling operations and development, utilization, and reclamation and abandonment through ground disturbing activities, unauthorized actions and alterations to setting and cultural landscapes. Mr. Gates surmises that geothermal development will likely result in adverse effects on archaeological resources within the lease areas. The nature of these impacts is described in Chapter 4 of Volume I of the PEIS. Additionally, as described in Chapter 2 of Volume I of the PEIS, various areas of cultural resources would have No Surface Occupancy stipulations: National Landmarks, National Register Districts, NRHP-listed and -eligible sites and their associated landscapes, traditional cultural properties, Native American sacred sites, and areas with important cultural and archaeological resources. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the boundaries of cultural resources those facilities cross and the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level, and would require inventories, evaluations, and appropriate treatments as outlined in the Best Management Practices of Appendix D in Volume III of the PEIS. Under these cultural resources Best Management Practices the BLM would also conduct Section 106

consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to the lease area and assess the level of impact of geothermal leasing and development on those resources. Project specific impacts after leasing would be reduced by implementing these Best Management Practices.

### 13.3.13 TRIBAL INTERESTS AND TRADITIONAL CULTURAL RESOURCES

#### Setting

Tribal interests include economic rights such as Indian trust assets, and resource uses and access guaranteed by treaty rights. Traditional cultural resources or properties include areas of cultural importance to contemporary communities, such as sacred sites or resource gathering areas. While most commonly considered in the context of Native Americans and Native Alaskans, there are traditional cultural resources associated with other ethnic or socially linked groups.

The lease application sites are within a culturally sensitive area of the western extreme of the Great Basin culture region as described in the Appendix I of the PEIS. The peaks of the Warner Range, in which the leases sit, are the designated separation between the Great Basin and California culture regions. Cultural aspects of both regions likely existed within the lease areas. The lease application sites are within the traditional territory of the Northern Paiute. Bengston (2003) provides a comprehensive ethnographic overview of the Northern Paiute.

Bengston (2003) identifies several categories of Northern Paiute traditional property types including traditional origin and historic places, ceremonial locations, historical locations, ethnohistoric habitation sites, trails, burial sites, and resource collection areas. Locations of these kinds of areas are commonly kept confidential by tribes and are unknown to the general public and agencies. Additionally, several concerns and issues of the Northern Paiute bands are identified. These include concerns for culturally significant areas, the environment, land ownership, and the authenticity of ethnographic documentation of tribal information. The Walker Range has been identified as a traditional plant collection area.

The majority of Northern Paiute reservations were established in Nevada. However, five reservations and colonies were established in northeast California (Bengston 2003). The nearest reservations to the lease area are the Cedarville and Fort Bidwell Reservations to the south and northeast, respectively (Bengston 2003).

A records search conducted for NFS lands within the lease application sites identified two known traditional cultural properties are located on peaks adjacent to the lease areas (Gates 2008). An additional third traditional cultural property is within CACA 043745. These would be considered significant cultural resources to local Native Americans and tribes.

Consultation with federally recognized tribes that are affiliated with the lease area was initiated on September 12, 2007 to identify and assess additional tribal concerns and traditional resources that may be affected by the undertaking. No responses from the tribes have been received as of the date of publication; however, the consultation process is considered on-going. While many traditional cultural resources are well known, some locations or resources may be privileged information that is restricted to specific practitioners or clans. For tribes, maintaining confidentiality and customs regarding traditional knowledge may take precedence over identifying and evaluating these resources, unless they are in imminent danger of damage or destruction.

## Impacts

### ***Alternative A (No Action)***

The No Action alternative would have no impact on Tribal Interests and Traditional Cultural Resources.

### ***Alternative B (Proposed Action)***

Impacts on Tribal Interests and Traditional Cultural Resources are assessed using the criteria found in Chapter 4 of Volume I the PEIS. Because issuing geothermal leases confers on the lessee a right to future exploration and development of geothermal resources within the lease area, it is a commitment or granting of a right that may interfere with other uses or interests. Although no tribal interests or concerns have been identified by the consultation process, the consultation process is considered on-going. Additional resources or concerns may be identified in the future by tribes. Impacts on Tribal Interests would be minimized or avoided by implementing Best Management Practices in Appendix D of Volume III of the PEIS for each of the phases of the Reasonably Foreseeable Development scenario as described in Chapter 2 of Volume I of the PEIS.

For traditional cultural resources, completion of the Section 106 process of the National Historic Preservation Act requires the BLM and FS to consult with the State Historic Preservation Office, tribes and other parties to identify and assess historic properties affected by the undertaking and develop measures to avoid, minimize, or mitigate any adverse effects of the undertaking on historic properties which includes traditional cultural properties. Three previously recorded traditional resources have been identified as within or adjacent to the lease areas, but no additional traditional resources have been identified by consulted tribes thus far. However consultation is considered on-going. Additionally, archaeological resources such as those discussed in Section

13.3.12, *Cultural Resources*, are often considered traditional resources by tribes. However, no direct impacts on Traditional Cultural Resources are expected to result from the Proposed Action of leasing since no rights to ground disturbing activities would occur.

Indirect and secondary impacts on the known and potential traditional cultural resources could occur from subsequent geothermal exploration, drilling operations, utilization, and reclamation and abandonment through ground disturbing activities, unauthorized actions and alterations to setting and cultural landscapes. The nature of these impacts and mitigations are described in Chapter 4 of Volume I of the PEIS. Areas of potential effect would include access roads, well pads, power plant footprints, pipeline and transmission line routes, and construction staging areas as well as the aspects of setting that contribute to significance. These areas of potential effect would be developed at the project-specific level, and would require inventories, evaluations, and appropriate treatments as outlined in the Best Management Practices of Appendix D in Volume III of the PEIS. Under these cultural resources Best Management Practices the BLM would also conduct Section 106 consultations with the State Historic Preservation Office, Native American tribes with ties to the project area, and local historic preservation groups to identify the presence and significance of cultural resources within or adjacent to the lease area and assess the level of impact of geothermal leasing and development on those resources. Project specific impacts after leasing would be reduced by implementing these Best Management Practices.

### 13.3.14 NATIONAL SCENIC AND HISTORIC TRAILS

#### Setting

The Lassen and Applegate trail segments of the California Historic Trail system traverse land approximately one mile from the NE corner of the NESE quarter section of township CA T44N R15E S14. Approximately 5,665 miles long, the trail was a major overland emigrant route across the Western US in the middle 19<sup>th</sup> century, used by over 200,000 farmers and gold-seekers to reach California (National Park Service 2008). The California National Historic Trail was the most often used route to the California goldfields, entering California in Surprise Valley immediately east of the lease area and continuing on over Fandango Pass (Bureau of Land Management 2008).

#### Impacts

##### **Alternative A (No Action)**

The No Action alternative would have no impact on national scenic or historic trails because no ground disturbing activities would be approved.

**Alternative B (Proposed Action)**

As stated in Section 4.16 of the PEIS, no geothermal leasing is allowed within one mile of a National Scenic or Historic Trail. Because the distance from the trail to the northeastern corner of the SE quarter section of Section 14, indirect impacts could occur should development at CACA 042989 occur. Depending on the type of structural development and roads needed, the proposed development could be visible from the trail and directly impact the visual character of the trail. The BLM would need to conduct an on-the-ground study determine the effects that development on CACA 042989 lease site would have on the trail. If necessary, the BLM may need to revise the lease boundaries to remove the 1-mile buffer from CACA 042989 prior to issuing the lease.

**13.3.15 VISUAL RESOURCES****Setting**

This section describes the visual resources in the region of influence, which is defined as the areas within and immediately surrounding the pending lease areas. Described below is the method for managing scenic resources and the visual landscape of the pending lease areas.

The scenery of the Forest is managed through the application of the Visual Management System (Agricultural Handbook- 462, National Forest Landscape Management, Volume 2, Chapter I, The Visual Management System). The Visual Management System was adopted by the Forest Service in 1974. The key component of the Visual Management System is the establishment of Visual Quality Objectives within the Land and Resource Management Plan.

There are five differing levels of Visual Quality Objectives (Visual Quality Objectives): Preservation, Retention, Partial Retention, Modification, and Maximum Modification. The following is a brief description of the five Visual Quality Objectives:

- Preservation – Allows ecological change only. Management activities are prohibited except for very low visually impacting recreation facilities.
- Retention – Management activities may not be visually evident. Contrasts in form, line, color and texture must be reduced during or immediately after the management activity.
- Partial Retention – Management activities must remain visually subordinate to the characteristic landscape. Associated visual impacts in form, line, color and texture must be reduced as soon after project completion as possible but within the first year.
- Modification – Management activities may visually dominate the characteristic landscape. However, landform and vegetative

alterations must borrow from naturally established form, line, color or texture so as to blend in with the surrounding landscape character. The objective should be met within one year of project completion.

- **Maximum Modification** – Management activities including vegetative and landform alterations may dominate the characteristic landscape. However, when viewed as background they must visually appear as natural occurrences within the surrounding landscapes or character type. When viewed as foreground or middle ground, they may not appear to completely borrow from naturally established form, line, color, or texture. Alterations may also be out of scale or contain detail which is incongruent with natural occurrences as seen in foreground or middle ground. Reduction of contrast should be accomplished within five years.

The pending lease sites are almost entirely within an Inventoried Roadless Area and visual retention zone. Appendix I of the Modoc National Forest Land and Resource Management Plan contains special stipulations for geothermal, oil, and gas leasing (US Forest Service 1991). A stipulation pertaining to visual resources protects highly scenic and sensitive visual areas as identified in Visual Quality Objectives as Retention and those areas identified in the Recreation Opportunity Spectrum as Semi-Primitive Non-Motorized. The Forest Service will require that the lessee's or operator's plan of operation is consistent with this stipulation, and may require restrictions or modifications to the operating plan. To protect areas, the lessee shall not conduct surface disturbing activities.

According to the Modoc National Forest Land and Resource Management Plan, the Forest offers a wide range of scenic landscapes (US Forest Service 1991). The Medicine Lake Highlands in the northwest portion of the Forest provides the beauty of mixed conifer stands intermixed with geologic evidence of past volcanic action (US Forest Service 1991). The Modoc Plateau, covering most of the Forest, is a combination of lava outcroppings with a diverse mixture of ponderosa pine stands, juniper, bitterbrush, sagebrush and mountain mahogany. The variety of vegetative color and texture and the distant views to mountain backdrops provide a unique scenic experience.

The Warner Mountains rise above the surrounding plateau on the east side of the Forest with peaks up to 9,800 feet (US Forest Service 1991). The Warner Mountains offer all the scenic amenities of the Sierra Nevada mountain range, and are covered by broken and diverse patterns of coniferous forests, aspen stands, open shrub-covered patches, rock outcrops and numerous streams.

The pending lease areas are in the foothills east of the Warner Mountains and west of both Upper Lake and California State Route 1. Prominent peaks in the area include Little Baldy (approximately 2,200 feet) and Buck Mountain

(approximately feet). Rough roads, Lake City Canyon, Boyd Creek, Powley Creek, Wilkinson Creek, Mill Creek, and Davis Creek South Fork cross the pending lease areas. The rolling hills are tan and dotted with sparse vegetation. The valleys and canyons with denser refuges of green vegetation visually contrast with the higher hilltops and ridges. Human-made modifications to the visual landscape are limited to roads of various conditions.

The Surprise Valley/Barrel Springs Back Country Byway is a route through Surprise Valley along a paved country road through quiet, small communities of white-framed houses, tall trees and gardens (Bureau of Land Management 2008). It follows State Route 1 past the pending lease areas. The Barrel Springs backcountry byway relies on the visual setting as a key component of the recreation opportunity experience (Bureau of Land Management 2007). With the exception of State Route 1, there are no sources of light in the pending lease areas.

Although some of the activities briefly described in CACA 043745 occur within CACA 043744 as well, there are far fewer activities due to the lack of road access and topography. The CACA 042989 area under Forest Service management is accessible by foot only.

## Impacts

The pending lease sites on NFS land are designated with a Retention Visual Quality Objective.

### **Alternative A (No Action)**

There would be no impacts on visual resources, because no surface development would occur. There would be no changes to visual resources.

### **Alternative B (Proposed Action)**

The potential risk of changes affecting visual resources is assessed for five significance criteria, which are described in Chapter 4 of the PEIS. Future actions based on the RFD scenario could result in changes that impact visual resources.

Future geothermal development activities could involve new structures, roads, and operations that are described in the RFD scenario. The new structures, roads, and operations would alter the characteristic landscape and be sources of light and glare. Because the pending lease areas are relatively undeveloped and readily visible due to topography and lack of obstructions, the impacts on visual resources would be noticeable. These impacts would be near areas where recreation (hunting, hiking, fishing) takes place or near areas where minimal nearby development exists. It would also be near a backcountry byway. Although stipulations outlined in Appendix B of the PEIS would minimize these impacts, geothermal resource development activities would be visually evident. Changes to visual resources based on the RFD scenario would result in impacts

on visual resources that would not be consistent with a Retention Visual Quality Objective.

### 13.3.16 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

#### Setting

The leasing sites cover approximately 5,200 areas within Modoc County. The County was selected as the region of influence for socioeconomic analysis as the impacts of leasing are likely to occur within this region. A summary of the population, housing, employment, local school data and low-income and minority populations for the County is provided based primarily on data from Census 1990 and 2000 population, demographic and housing information (US Census Bureau 1990, 2000).

#### **Population**

In 2006, population in Modoc County was estimated at 9,587. This is a 1.6 percent population change from 2000, when the total population within the county was 9,449. Between 1990 and 2000 population decreased by approximately 2.3 percent. Projections for 2020, place Modoc county at a population of 11,500 (California Department of Finance 2001).

#### **Housing**

In 2000, there were 4,807 total housing units, 3,784 of these were occupied and 2,675 owner occupied, for an owner vacancy rate of 5.1 percent and a rental vacancy rate of 9.3 percent. In 1990, there were 4,672 total housing units, of which 3,711 units were occupied and 2,583 were owners occupied, with an owner vacancy rate of 3.6 and a rental property vacancy rate of 7.8 percent (US Census Bureau 1990, 2000).

#### **Employment**

In 2000 the workforce consisted of 4,128 people of which 493 people or 10.2 percent were unemployed. This is a slight decrease in unemployment from previous census data in 1990, when the labor force consisted of 3,982 people of which 418 people, 10.5 percent were unemployed. Median household income was \$27,522 in 2000 and in 1990 median income was \$22,029. Median income is lower than the state average, which was \$47,493 in 2000 (US Census Bureau 1990, 2000). Some of this difference may be due to unreported income from activities such as fuel wood gathering and family farm labor as well as seasonal employment fluctuations.

Based on 2000 data, the industries employing the greatest percent of the population in Modoc County include educational, health and social services (25.4 percent); agriculture, forestry, fishing and hunting and mining (18.2 percent); public administration (10.1 percent) and retail trade (12.3 percent) (US Census Bureau 2000).

### **Schools and Public Infrastructure**

In 1990, 1843 students were enrolled in K-12 education in Imperial County. In 2000 this number increased to 2,005 students. Modoc County includes Modoc Joint Unified School District, Surprise Valley Joint Unified School District and Tulelake Basin Joint Unified School District (Modoc County Office of Education 2007).

### **Environmental Justice**

The Caucasian/Non-Hispanic population is the dominant ethnicity in Modoc County, at approximately 85.9 percent of the population in 2000. The Hispanic/Latino population increased 37 percent from 1990 to 2000. In 2000, Hispanic/Latinos comprised approximately 11.5 percent of the population. 2006 estimates indicate that this minority comprised 11.8 percent of the population in 2006, indicating that Hispanic/Latino population is continuing to increase in the county (US Census Bureau 2008). See Table 13.3-5 for a summary of population in Modoc County by ethnicity.

**Table 13.3-5  
Race/Ethnicity in the Modoc County**

	1990	2000	Percent Change
Total Population	9678	9449	-2.3
White/Non-hispanic	8803	8120	-7.8
Black/African American	78	65	-16
American Indian/Alaskan Native	406	398	-2.0
Asian	40	58	+31
Pacific Islander*	N/A	7	N/A
Other	351	538	+35
Two or more*	N/A	263	N/A
Hispanic or Latino**	701	1088	+36

Source: US Census Bureau 1990, 2000.

\* Not reported on 1990 census: Asian and Pacific Islanders were one group and more than one race was not an option.

\*\* In combination with other race. Totals may add to more than 100 percent as individuals can report more than one race.

In 1999 census information, people, or 21.5 percent of individuals for whom poverty status was determined were living below the poverty level. This is an increase over 1989 data, which indicated that approximately 1,396 individuals or 15 percent of the population were living below poverty level (US Census Bureau 2000).

## Impacts

### **Alternative A (No Action)**

The No Action alternative would have no impact on existing socioeconomics in Modoc County. No impacts would occur to minority or low income populations.

### **Alternative B (Proposed Action)**

The Proposed Action would have no direct impacts on socioeconomics or environmental justice. Indirect impacts include a potential increase in jobs and decrease in unemployment in Modoc County due to construction and operations and maintenance jobs at a newly developed geothermal plant. Given the reported unemployment rate of over 21 percent in 2000, it is likely that many of the jobs created by a power plant would be filled by county residents and should not result in a large population influx. As a result, impacts to local schools or other public infrastructure would be minimal. Geothermal development would also be a positive stimulus to the local economy through increased tax revenues at the county and state levels.

The RFD scenario predicts two 20 MW plants will be developed in the pending lease area. Impacts of a standard 50 MW plant are discussed in Section 4.18.3 *Socioeconomics and Environmental Justice* in Volume I of the PEIS. Similar impacts to those discussed in the PEIS are likely for this pending lease area; however, impacts would be reduced according to the smaller capacity of the plants in the pending lease area. Impacts to Hispanic/Latino individuals or individuals of low income populations are possible as these groups have a significant presence in the County. Due to the absence of residences in and around the pending lease sites impacts would be minimal.

## 13.3.17 NOISE

### **Setting**

Current sources of noise in the pending lease areas are limited to wind, dispersed recreational use, occasional traffic on roads within the leasing site boundaries, and wildlife. Sources of noise originating outside of the pending lease areas but affecting the pending lease areas include traffic from adjacent roads, air traffic, and activity from a nearby residence.

Sensitive noise receptors are generally considered to be homes, hospitals, schools, and libraries. Sensitive receptors within the pending lease area are limited to one residence located along Surprise Valley Road, approximately between 180 and 230 yards to the east and southeast of proposed lease site CACA 042989. No other residences or developments lie within half a mile of the site. Wildlife is also considered to be a sensitive noise receptor, depending on the species present in the project area. Wildlife in the project area is

discussed in sections 13.3.9, *Fish and Wildlife*, and 13.3.10 *Threatened and Endangered Species and Special Status Species*.

## Impacts

### ***Alternative A (No Action)***

The No Action alternative would have no impact on noise because no ground disturbing activities would be approved.

### ***Alternative B (Proposed Action)***

The Proposed Action would not have any direct impact on noise, but would potentially result in indirect impacts to noise in the pending lease areas. No sensitive receptors have been identified within the pending lease areas. Adjacent and nearby sensitive receptors would be protected from noise impacts since any projects approved by the BLM would be required to adhere to the BLM regulations, requiring that noise from a major geothermal operation shall not exceed 65 A-weighted decibels at the lease boundary. Impacts to wildlife from noise sources are discussed in Sections 13.3.9, *Fish and Wildlife*, and 13.3.10 *Threatened and Endangered Species and Special Status Species*.

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## SECTION 13.4

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