

# Glass Mountain Area Geophysical Studies

## Environmental Assessment

CA320-NEPA-09-05

Siskiyou County, California

December 2008

**Prepared for:**

US Bureau of Land Management  
Alturas Field Office  
708 W. 12 Street  
Alturas, California 96101

**Prepared by:**

RMT Inc.  
4 West Fourth Avenue, Suite 303  
San Mateo, California 94402



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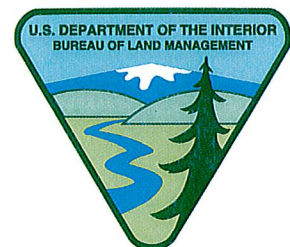
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# 1: INTRODUCTION

## 1.1 Identifying Information

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### 1.1.1 PROJECT BACKGROUND

The Alturas Field Office of the US Bureau of Land Management (BLM) is preparing this Environmental Assessment (EA) to address the environmental effects of the Glass Mountain Geophysical Survey project. Calpine Corporation (Calpine) submitted a Notice of Intent to Conduct Geothermal Resource Exploration Operations (OMB No. 1004-0132) in March 2008. The application describes Calpine's proposal to conduct geophysical surveys within the Glass Mountain Known Geothermal Resource Area (KGRA) (Figure 1.1-1). The surveys would employ magnetotelluric (MT) and time-domain electromagnetic methods (TDEM), the same methods used in similar surveys conducted in 2005.

The project includes the following elements:

- Scouting and preliminary review of proposed survey sites
- Collecting data from 120 MT stations
- Collecting data from 120 TDEM stations

### 1.1.2 PROJECT LOCATION

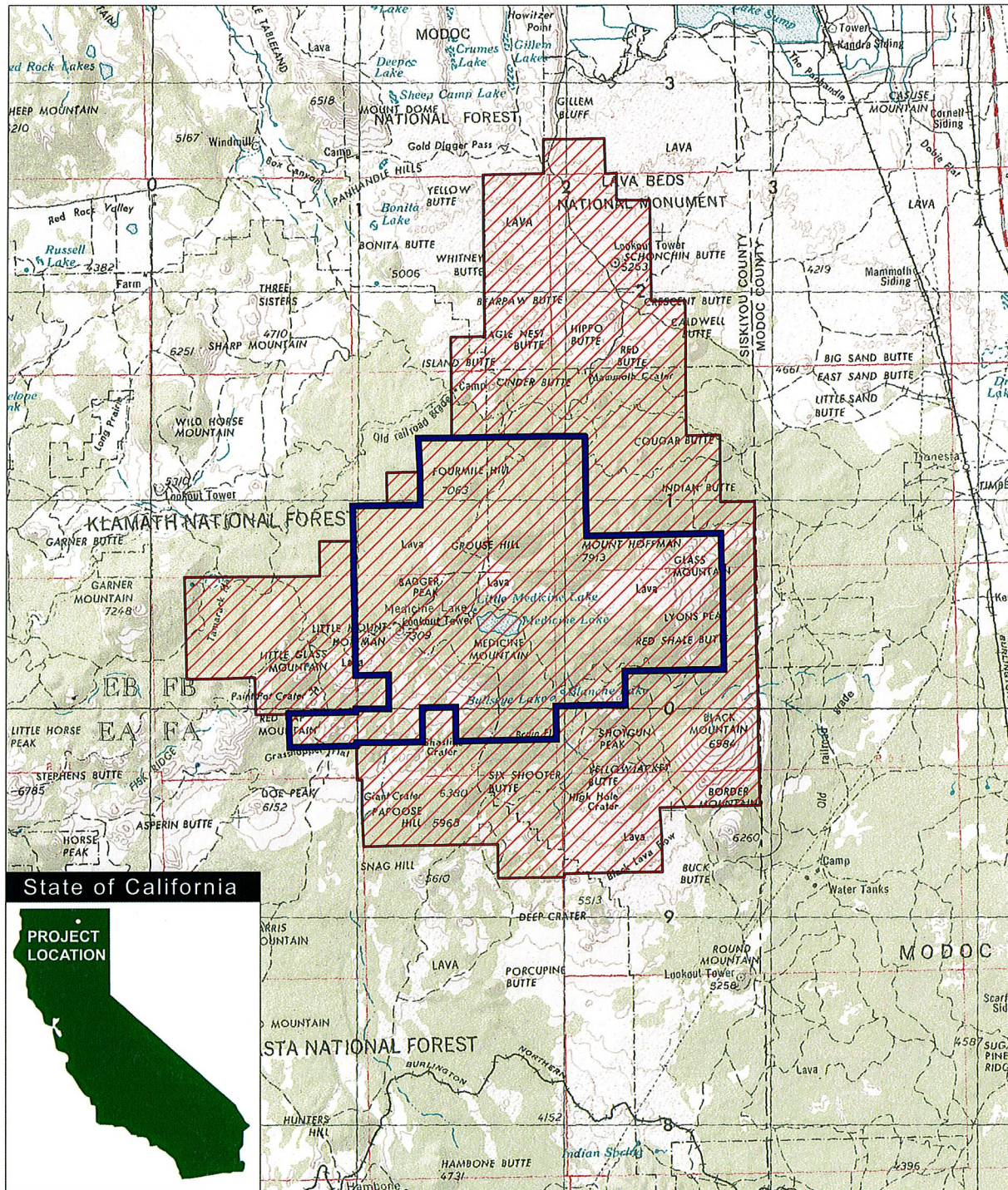
The proposed action would be located within the Glass Mountain Federal Geothermal Unit originally designated in the Unit Agreement for the Glass Mountain KGRA that was approved by the BLM in 1982. Unit Agreements provide for a cooperative plan among responsible agencies and geothermal exploration companies to explore and potentially develop a geothermal resource.

The surveys would take place in the Medicine Lake Highlands, about 30 miles northeast of Mount Shasta (Figure 1.1-2 and 1.1-3). The proposed project is located on geothermal leases issued by the BLM to Calpine (leases CA-12372, CA12371, CA-1230, CA-6111).

The project is located within the Shasta-Trinity National Forest, the Modoc National Forest, and the Klamath National Forest.



**Figure 1.1-1: Glass Mountain KGRA and the Project Area**




SOURCE: ESRI 2006, USGS EROS Data Center 2008, California Department of Conservation 2005, and RMT 2008

**LEGEND**



 Project Area

 Glass Mountain KGRA

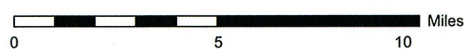
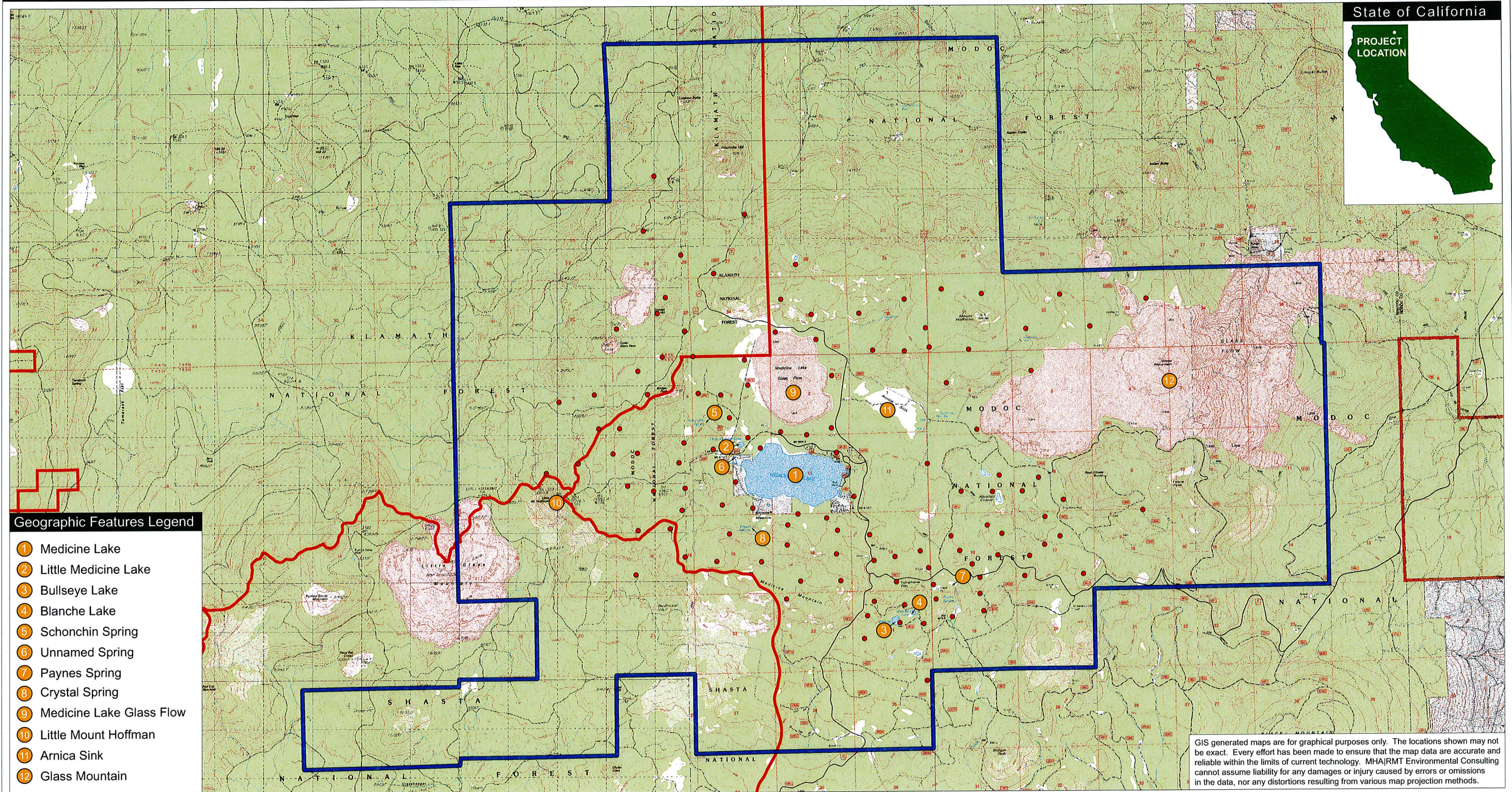




Figure 1.1-2: Topographic Map of the Project Area



SOURCE: U.S. Geological Survey, EROS Data Center, Sioux Falls, SD and RMT 2008

LEGEND

- Proposed MT / TDEM Station (not to scale)
- Calpine Federal Lease Boundary
- National Forest Area Boundary

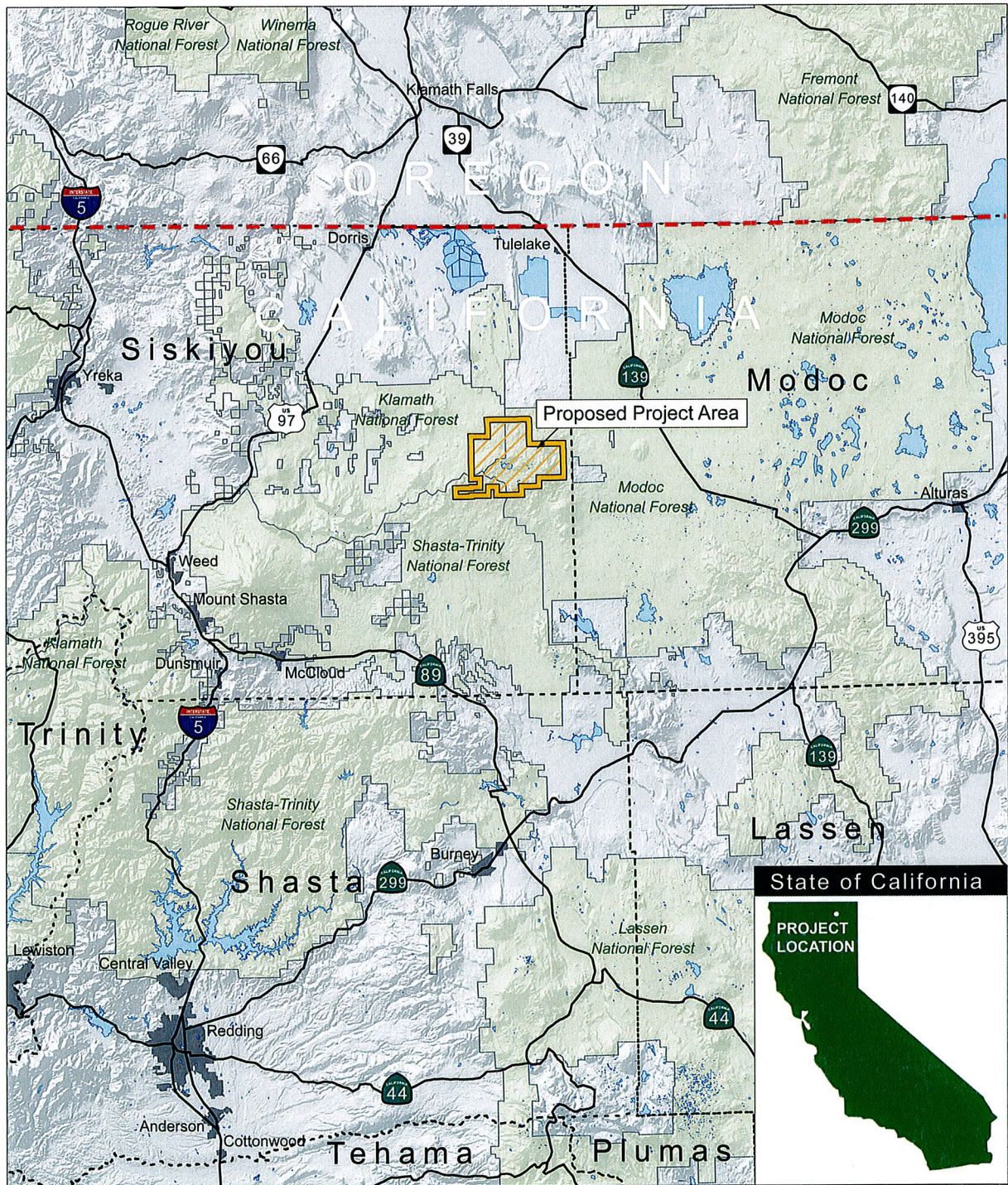




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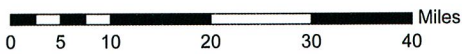
**Figure 1.1-3: Proposed Project Location**



SOURCE: BLM, Alturas Resource Area Office 2003 and RMT 2008

**LEGEND**

-  Proposed Project Area
-  U.S. Highway
-  California State Route
-  Interstate Highway
-  Oregon State Route





### 1.1.3 ENVIRONMENTAL REVIEW

The BLM is the lead agency under the National Environmental Policy Act (NEPA) because the project would be located on lands leased for geothermal exploration. The August 14, 2007 Federal Register, Section 11.9 states that geophysical surveys for geothermal exploration of federal lands are eligible for a Categorical Exclusion from the National Environmental Policy Act (NEPA) as a casual use when no temporary or new road construction is proposed. Due to sensitive cultural resources in the area, and heightened public interest, the BLM has decided to prepare an EA for this project. The US Forest Service (USFS) is acting as a cooperating agency. The BLM will consider this EA and the effects of the proposed action prior to deciding whether to authorize the project. This EA is prepared in accordance with the requirements of NEPA and the BLM NEPA Handbook H-1790-1 (January 2008). This document describes the proposed geophysical surveys and alternatives to the proposed action, identifies the affected environment and impacts of the proposed action and alternatives, and identifies mitigation measures to minimize or eliminate adverse impacts.

There are four stages of geothermal resource development within a lease:

- 1) Exploration
- 2) Development
- 3) Production/utilization
- 4) Reclamation

Each of the four stages requires BLM authorization and compliance with NEPA when ground-disturbing activities are proposed. The Glass Mountain Geophysical Survey Project is of an exploratory nature and does not include development or utilization of the resource, although development was previously authorized after the preparation and approval of the Fourmile Hill Geothermal Development Project Final EIR/EIS in 1998.

## 1.2 Purpose and Need for Action

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### 1.2.1 PURPOSE

The purpose of the proposed project is to explore the potential for the existence of geophysical characteristics that indicate the potential for successful geothermal development on BLM federal leases held by Calpine, pursuant to the Geothermal Steam Act of 1970.

Similar MT and TDEM surveys were completed in October 2005. The proposed surveys would fill in the gaps in data between stations that proved to be conceptually important in the 2005 surveys. The geophysical surveys would better refine the location and extent of geophysical anomalies and reduce the number and extent of exploration wells that might be needed to locate the geothermal resource, if exploration were to continue in the future.

### 1.2.2 NEED

The need for the project is to meet the requirements of the National Energy Policy Act of 2005, the BLM's implementation strategy titled, *BLM Implementation of the National Energy Policy*, and other federal policies that encourage the use of alternative and renewable energy.

The Geothermal Steam Act of 1970, amended and supplemented by the National Energy Policy Act of 2005; the Mining and Mineral Policy Act of 1970; the Federal Land Policy and Management Act of 1976; and the National Materials and Mineral Policy, Research and Development Act of

1980 direct the federal government to foster and encourage private enterprise to develop alternative energy resources with appropriate environmental constraints.

The Department of Interior policy, consistent with Section 2 of the Mining and Mineral Policy Act (MMPA) of 1970 and sections 102(a)(7), (8), and (12) of the Federal Land Policy and Management Act (FLPMA) of 1976, is to encourage the development of mineral resources, including geothermal resources, on federally managed lands. The Secretary of the Interior has the authority and responsibility to lease public lands and certain other federal lands for geothermal development. The Secretary has delegated this responsibility to the BLM. Under the terms of the Geothermal Steam Act (and the National Energy Policy Act) and its implementing regulations, the BLM must respond to the plans and programs submitted by the lessee (or unit operator) and either approve, require modification, or deny these applications.

The Medicine Lake Highlands are culturally significant to the Pit River, Klamath (and Shasta) Tribes. The project must also address and protect cultural values and identify opportunities for enhancement of cultural values through project design. The project applicant and the BLM would work in the spirit of the Memorandum of Agreement (MOA) among the USFS, the US BLM, the California State Historic Preservation Office and the Advisory Council on Historic Preservation regarding the Fourmile Hill Geothermal Development Project (Agreement), as amended 2005. Section III (1) of MOA states that “for purposes of the Agreement, the USFS and BLM shall treat the Highlands as a whole as a landscape that is eligible for inclusion as such in the National Register of Historic Places. Individual locations of cultural, spiritual, historical and archaeological importance within this landscape will be understood to contribute to the landscape’s eligibility.”

### 1.3 Scoping and Public Involvement Issues

Comments on the scope of this assessment were sought from the public, regulatory agencies, and other interested parties as part of the EA process. A letter describing the scope of the project was sent out to all parties on the project’s distribution list on June 9, 2008. Copies of the letters, distribution list, and responses are included in Appendix A to this EA. One comment letter was received during scoping. Comments have been considered during the preparation of this Draft EA.

The US Fish and Wildlife Service (USFWS) and the California Office of Historic Preservation (OHP) were contacted to solicit comments related to effects to threatened and endangered species and cultural resources. The BLM will consult with the USFWS and the SHPO according to the requirements of Section 7 of the Endangered Species Act and Section 106 of the National Historic Preservation Act (respectively). The BLM also presented the project to the Pit River Tribe on June 5, 2008 and August 14, 2008 and solicited comments and concerns regarding the proposed action. The Klamath Tribes declined further consultation regarding this project in a phone conversation with a BLM representative on July 7, 2008.

Key issues raised during scoping include:

- No exploration should be allowed around Medicine Lake or any of the other lakes or streams in the area
- Water quality impacts should be addressed
- Calpine should be required to adhere to forest road closures while conducting the surveys and must not travel off-road
- Impacts to forests and trees should be addressed
- Impacts to historic properties need to be addressed





# 2: PROPOSED ACTION AND ALTERNATIVES

## 2.1 Overview

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This chapter describes the Proposed Action and the No Action Alternative. The project would be located within the Glass Mountain KGRA, in the Medicine Lake Highlands, as shown in Figures 1.1-1 and 1.1-2. The Alturas Field Office of the BLM will make a final decision on whether or not to authorize Calpine's Proposed Action or an alternative.

## 2.2 Description of Proposed Action

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### 2.2.1 OVERVIEW OF THE PROPOSED ACTION

Calpine proposes to conduct MT and TDEM geophysical surveys on their leased lands in the Glass Mountain KGRA. The proposed project would include collecting data from 120 stations. The preliminary survey locations are shown in Figure 1.1-2. Survey sites are not fixed and can be relocated if biological, cultural, or other important resources could be impacted. The time period in which the survey would be completed would span 5 to 8 weeks and would likely occur in early 2009.

The methods and contractor utilized by Calpine in 2005 to conduct a similar survey would also be used for the proposed survey. The survey methods would not require the use of any mechanical construction equipment and would not require construction of new roads. Many TDEM data collection stations will be used when MT data are acquired at the same location. A trained archaeological monitor is proposed to travel with the survey team and would relocate any data collection points as needed to avoid archaeological resources.

This MT-TDEM project is designed to reduce the impact of geothermal development by more fully characterizing the resource geometry. Besides reducing the likely number of exploration wells and pads required, the understanding of the resource geometry derived from the MT beyond the drilled area will allow the initial development to be designed with a view to long term minimization of impact by surface facilities.

## 2.2.2 MAGNETOTELLURIC SURVEYS

### Overview of Survey Method

One of the two survey methods proposed by Calpine is an MT survey. MT is used in the geothermal industry to obtain images of rock resistivity<sup>1</sup> to depths of many thousands of feet below ground surface. MT surveys are used to map the difference in resistivity and thus temperature in clays that form above and within geothermal reservoirs. MT is used to improve geothermal resource conceptual models and reduce the total number of wells and pads necessary to explore and appropriately develop geothermal resources.

The MT method uses electrodes and magnetometers to measure natural electric and magnetic fields at the surface of the earth that are caused by electromagnetic waves radiated from the sun and from distant electrical storms on the Earth's surface. The MT equipment has no live current. The earth's magnetic field varies slowly while the electric field responds more directly to the currents they induce in rocks. The ratio of the earth's electric field to the magnetic field is proportional to rock resistivity.

An MT sounding is made by recording the electric and magnetic fields over a range of wave frequencies. The electric field of a high-frequency electromagnetic wave dissipates at shallow depths whereas the electric field at low frequencies dissipates at much lower depths. For geothermal applications, recording MT from 0.01 to 300 hertz (Hz) provides resistivity imaging for a range of depths from about 300 feet to much greater than 30,000 feet. This range covers the transition from the low-resistivity clays above the reservoir to the relatively higher-resistivity clays in the reservoir.

Because MT uses natural signals, there is no option to increase the signal strength if cultural noise from power lines or roads disturbs the measurements. However, the MT signal sources (the Sun and worldwide lightning) are usually strong enough to overcome most types of background noise if MT stations are recorded for greater than 12 hours.

### Equipment

A set of MT equipment used to record a station for the planned survey consists of:

- Four insulated wires attached to five electrodes inserted into the ground
- Three coil magnetometers in PVC tubes about 48 inches long and 4 inches wide (two horizontally placed magnetometers and one vertically placed magnetometer)
- A recording system about the size of a small piece of carry-on luggage
- A sealed battery

Examples of equipment are shown in Figure 2.2-1.

### Installation and Recordation

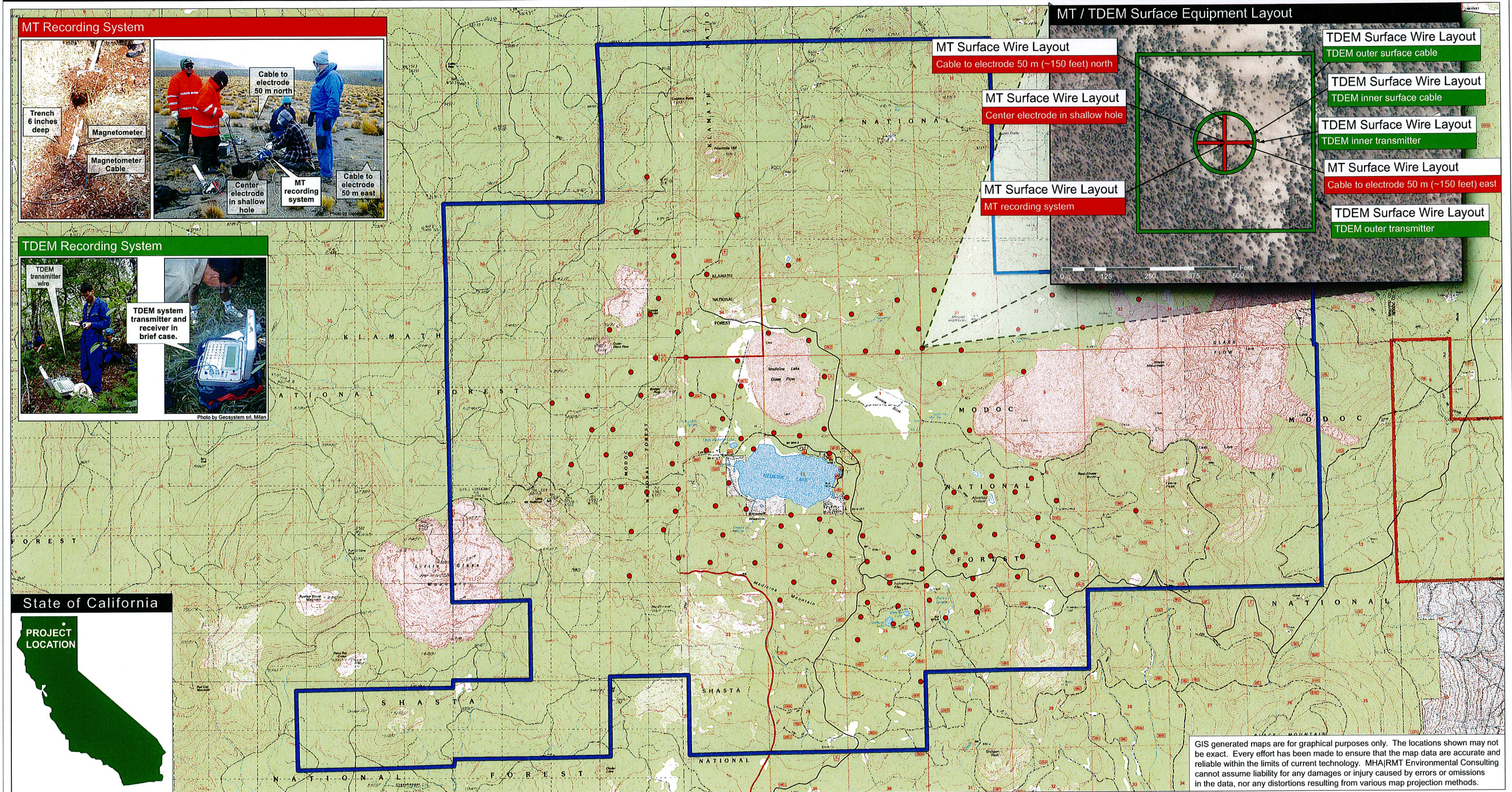
Four insulated wires, each about 150 feet long, are laid out by hand in a plus-sign pattern, as illustrated in Figure 2.2-1, and are electrically connected to the ground through five electrodes of two possible types. Porous electrodes are usually buried in small holes about 6- to 12-inches deep and 6 inches wide using a hand held post-hole digger. If steel stake electrodes are used, they are usually hammered in as far as they will go by hand, or to a maximum of about 18 inches. In cases

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<sup>1</sup> Electrical resistivity (also known as specific electrical resistance) is a measure of how strongly a material opposes the flow of electric current. A low resistivity indicates a material that readily allows the movement of electrical charge. Different rock types have different resistivity properties.



Figure 2.2-1: Proposed Project Elements



SOURCE: U.S. Geological Survey, EROS Data Center, Sioux Falls, SD and RMT 2008

**LEGEND**

N  
W E  
S

Proposed MT / TDEM Station (not to scale)

Calpine Federal Lease Boundary

0 0.5 1 2 3 4 Miles

**RMT**  
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where it is difficult to achieve a good electrical contact with the rock or soil, a few quarts of fresh or slightly salty water and/or wet bentonite clay may be placed in the bottom of a hole dug for a porous electrode, or poured beside a steel stake. The steel electrodes are faster to install; however, the porous electrodes are electrically more stable and are required when recording for longer than an hour.

An individual MT grid or installation is approximately 300 feet by 300 feet in size.

To avoid wind vibration and resulting noise, the two horizontal magnetometers are usually buried in two 48-inch long, 6-inch deep trenches and the vertical magnetometer is partially buried in a 24-inch deep hole dug with a post-hole digger. A plastic pail is placed over the protruding vertical coil of the magnetometer to shield it from the wind.

The recording system is connected to the electrode wires and the magnetometer signal cables after the electrodes and magnetometers are installed, and the data are recorded. The system is usually left running unattended overnight to collect 14 hours of high-depth data. Shallow data can be recorded in less than an hour. Depending on variations in the subsurface resistivity patterns, the spacing between MT stations may vary from several miles to a few hundred feet.

All systems would be collected after completion of the individual survey. Areas of minimal excavation would be reclaimed with the stockpiled topsoil and vegetation that was removed to install the magnetometers and electrodes.

### **Personnel and Timing**

Survey operations are conducted by two or three independent crews, each consisting of two to five workers. Typically one crew is assigned to one vehicle, unless safe operation requires more vehicles. Only existing roads would be used to access sites. If the station site is not accessible by vehicle along an existing road, the equipment can be easily carried to the site by two to five people using backpacks. The number of stations recorded by each crew varies depending on access and the depth of investigation required. It takes 20 minutes to 1 hour to lay out a station, 1 to 14 hours to acquire the data, and 30 minutes to pick up the station and move to the next station. Each crew carries one to three recording systems and can record two to six MT soundings per day, depending on access and recording duration. For recordings of 14 hours duration, the equipment is usually left running overnight at the station and picked up the next morning.

The project team at each station would include an archaeological monitor and a Native American monitor that would investigate and “clear” all areas prior to installation of an MT station. If archeological resources are found in a proposed site location, the resources would be noted by the archaeological monitor and the survey would be moved to a new area that does not contain cultural resources. The project team would also include a botanist to ensure that no rare or ethnobotanical plants would be impacted by the minimal excavation necessary for MT survey work.

### **2.2.3 TELLURIC-ONLY SURVEYS**

An alternative method called T-MT can be used in areas where restrictions are placed on soil disturbance necessary for the placement of MT coils and electrodes, or where burying coils is impractical. Telluric-only stations are recorded at the same time as two or more standard MT stations are recorded within ten miles of the telluric stations.

Telluric stations in this context are MT stations without magnetic field measurements. The data are acquired by carrying an MT recorder to the station location and connecting it using four wires that 150 feet long to five small electrodes. In areas where digging is prohibited, the porous electrodes are placed on the surface of the ground in contact with the underlying soil or rock. A quart of water

may be poured on the ground to improve the electrode contact. If the electrode is placed on a hard surface, such as the volcanic rocks in the area, then the electrode would be placed onto a wet, clean clay layer fewer than 4 inches wide and 1 inch thick.

The two- to four-person crew would leave the recorder to acquire data for 1 to 12 hours and would later return to pick up the equipment. Any clay that was used would be removed after the measurement was completed and be reused at other stations. If the resistivity variations are smooth and have few shallow vertical conductive zones, as is typical of geothermal prospects, there would be little or no loss of resolution from collecting telluric stations instead of MT stations.

Although the use of telluric stations with electrodes installed on the ground surface does have higher risk of collecting incomplete or noisy data, in cases where even minimal disturbance of the soil is of concern, it can be an effective option. Variable sources of noise (such as wind) have greater effect on surface electrodes; therefore, T-MT stations are most effective when they are part of a larger conventional survey so that they can be acquired on the least windy days.

## **2.2.4 TDEM SURVEYS**

### **Overview of Survey Method**

The TDEM survey relies on electromagnetic induction between an undergrounded wire loop and the earth for both transmission and detection of signals. It requires no electrical contact with the earth, which means that it is not subject to the same types of distortion that can affect any method that measures the resistivity of the earth using electrodes, such as MT. TDEM cannot detect resistivity patterns as deep as a geothermal reservoir but, because of its relative immunity to distortion, it reduces uncertainty in MT images.

The most common TDEM approach is to send a steady current into a large wire loop laid out on the ground to generate a vertical magnetic field and then suddenly switch off the current, inducing decaying smoke rings of current in the earth as the magnetic field decays. The decaying vertical magnetic field generates a voltage in a detection coil in the center of the loop, and the voltage is recorded. The voltage decay in the detector depends on the resistivity pattern of the underlying rocks; therefore, TDEM also measures resistivity in rock.

### **Equipment**

TDEM survey equipment usually consists of a wire loop antenna, a transmitter/receiver unit, and a sealed battery, as shown in Figure 2.2-1. The loop antenna is a single strand of insulated wire laid out in a square pattern on the earth's surface, generally with a perimeter of 1,200 to 4,000 feet. A briefcase-sized transmitter/receiver unit is connected to one corner of the loop, and energizes the wire with a current from a sealed battery, or, in rare cases, a small gasoline generator. The same loop is used to both transmit and detect the signal response in the type of TDEM that would be used in the proposed surveys.

The loop is normally laid out and retrieved by walking the footprint of the loop and laying out and recoiling the wire by hand. Depending on expected variations in the subsurface resistivity, the TDEM loops may be laid out as individual stations separated by up to several miles, usually at MT station locations, or along continuous profile lines where the edge of one station coincides with an edge of an adjacent station (Figure 2.2-1). The TDEM survey requires no ground disturbance.

The TDEM transmitter loop is insulated, ungrounded, and the loop voltage and amperage is low in the type of geothermal TDEM survey planned. There is no electrocution hazard. Fire hazard is minimal, mainly related to a motor generator if one is used. Loops are not laid across roads to prevent vehicle tangle in the transmitter wire.

## Personnel and Timing

A crew of two to five workers, usually using only one vehicle unless safe operation requires more, conducts survey operations. Vehicles would only travel on existing roads. If the station site is not accessible by the existing roads, three people using backpacks can easily carry the equipment to the site. Depending on the size of loop used, it takes 15 to 60 minutes to lay out a station, 5 to 20 minutes to acquire the data, and 10 to 30 minutes to pick up the station. Three to nine TDEM soundings per day can be acquired by a single crew. In some cases, a TDEM system may be carried by an MT crew and recorded at the same location while setting up or removing the MT system.

The project team at each station would include an archaeologist and Native American monitor that would investigate and “clear” all areas prior to installation of a TDEM station. If archeological resources are found in a proposed site location, the resources would be noted by the archaeologist and the survey would be moved to a new area that does not contain resources.

### 2.2.5 SAFETY AND TRAINING

Calpine would generate a prospect-specific hazard assessment plan as well as a safety contingency plan. The contingency plan contains spill prevention and contingencies for hydraulic, motor oil, and/or used diesel fuel spills. These fluids are the extent of hazardous materials brought into the field. Calpine also has a formal training program for personnel, which includes 32 hours of safety courses including defensive driving, first aid, CPR, all-terrain-vehicle (ATV) safety, and lockout/tagout<sup>2</sup>.

Calpine maintains a database on how current all employees are with their safety training and the courses required for each position. All survey crew members wear safety vests, hardhats, and goggles when required. Crewmembers would also be trained as to operating procedures, the safety procedures, and access on Forest Service lands prior to project commencement. New crew members would receive tailgate training prior to authorization to work on Forest Service lands.

## 2.3 Description of Alternatives Analysis

### 2.3.1 NEPA REQUIREMENTS

NEPA requires that a reasonable range of alternatives to the Proposed Action be considered that could feasibly meet the objectives of the Proposed Action as defined in the purpose and need for the project [40 CFR 1502.14(a)] (see Chapter 1). The range of alternatives required is governed by a “rule of reason” (i.e., only those feasible alternatives necessary to permit a reasoned choice need be considered). Reasonable alternatives are those that are practical or feasible based on technical and economic considerations [46 Federal Register 18026 (March 23, 1981), as amended; 51 Federal Register 15618 (April 25, 1986)].

Alternatives to the Proposed Action must be considered and assessed whenever there are unresolved conflicts involving alternative uses of available resources [BLM NEPA Handbook H-1790-1, page 49 (BLM 2008)].

<sup>2</sup> "Lockout/tagout" refers to specific practices and procedures to safeguard employees from the unexpected energization or startup of machinery and equipment, or the release of hazardous energy during service or maintenance activities. This requires, in part, that a designated individual turns off and disconnects the machinery or equipment from its energy source(s) before performing service or maintenance and that the authorized employee(s) either lock or tag the energy-isolating device(s) to prevent the release of hazardous energy and take steps to verify that the energy has been isolated effectively (OSHA 2004).



### **2.3.2 ALTERNATIVES CONSIDERED**

Given the minimally invasive nature of the project, and the limitations on how the surveys can be performed, there is no feasible alternative that also provides Calpine with collection of survey data, as stated in the project purpose and need. There are no other survey methods available that would allow the same data to be collected and would have a lesser impact than the proposed project. The project itself incorporates the ability to move stations to avoid biological or cultural resources.

### **2.3.3 NO ACTION ALTERNATIVE**

Under the No Action Alternative, BLM would not allow the completion of the proposed geothermal surveys. The use of the geothermal resource would remain the same. The area would essentially maintain its current state. The data would not be gathered to refine the potential drilling locations for exploratory geothermal wells, if exploration were to continue. The No Action alternative would likely increase the risk of non-commercial wells that would need to be abandoned and reclaimed.

## **2.4 Land Use Conformance Statement**

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### **2.4.1 OVERVIEW**

Several land use plans pertain to the project area. Plans include:

- Klamath National Forest Land and Resource Management Plan (1995)
- Modoc National Forest Land and Resource Management Plan (2001)
- Shasta-Trinity National Forest Land and Resource Management Plan (1995)
- Medicine Lake Highlands Historic Properties Management Program (2008)

### **2.4.2 USFS FOREST PLANS**

The Proposed Action is consistent with the Klamath National Forest Land and Resource Management Plan (2001). The management goal is to “manage mineral exploration and development of surface resources so as to maintain the environmental quality (to the extent feasible)” (USFS 2001a). Effects of the proposed project are minimal and additional mitigation has been presented in this EA.

The Proposed Action is consistent with the Modoc National Forest Land and Resource Management Plan (2001). The management guidelines for mineral activities are to “manage mineral, geothermal, and oil and gas activity in a manner compatible with semi-primitive non-motorized recreation direction. Apply a conditional no-surface occupancy stipulation to leasable minerals.” Management guidelines for Medicine Lake – Management Area 61 and Black Mountain – Management Area 62 are that “Other management activities should not preclude geothermal development” (USFS 2001b).

The Proposed Action is consistent with the Shasta-Trinity National Forest Land and Resource Management Plan (1995). The management guidelines for the leased lands in this area is to “plan for geothermal and common minerals development in coordination with the area’s significant geologic and visual resource values” (USFS 1995). Geologic and visual resources are considered in this EA, and measures to minimize effects are presented.

### **2.4.3 MEDICINE LAKE HIGHLANDS HISTORIC PROPERTIES MANAGEMENT PLAN**

The Medicine Lake Highlands Historic Properties Management Program (2008) is applicable to the project area; however, it is meant to provide “guidance for management of the cultural, spiritual

and natural resources in the (Medicine Lake) Highlands but is not a decision document in terms of NEPA decisions or forest plan amendments” (BLM and USFS 2008). The project would not be in conflict with the Medicine Lake Highlands Historic Properties Management Plan.





# 3: AFFECTED ENVIRONMENT

## 3.1 Introduction

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### 3.1.1 OVERVIEW

This section of the EA provides a description of existing environmental conditions and applicable regulations within the area of proposed geophysical surveys and the surrounding vicinity. The descriptions, by environmental parameter, are based on consultations with agency personnel, knowledge and experience in the region, and information provided in the following documents:

- Glass Mountain Exploration Environmental Assessment/Initial Study (BLM et al. 2002)
- Telephone Flat Geothermal Development Project Final EIS/EIR (BLM et al. 1999)
- Fourmile Hill Geothermal Development Project Final EIS/EIR (BLM et al. 1998)
- Glass Mountain Unit Geothermal Exploration Project EA/IS (BLM et al. 1995)
- Fourmile Hill Area Geothermal Exploration Project EA/IS (BLM et al. 1995)
- Klamath National Forest Land and Resource Management Plan (USFS 2001)
- Modoc National Forest Land and Resource Management Plan (USFS 2001)

### 3.1.2 ENVIRONMENTAL EFFECTS

Appendix 5 of the BLM NEPA Handbook H-1740-1 (BLM 2008) identifies Critical Elements of the Human Environment that are subject to requirements specified by statute or executive order and must be considered in all BLM environmental documents. Table 3.1-1 lists the Critical Elements and their status in the project area.



<b>Table 3.1-1: Critical Elements Pertinent to the Project</b>			
<b>Critical Element</b>	<b>Not Present *</b>	<b>Present/Not Affected *</b>	<b>Present/May Be Affected**</b>
Air Quality			X
Areas of Critical Environmental Concern	X		
Cultural Resources			X
Environmental Justice			X
Farm Lands (prime or unique)	X		
Floodplains		X	
Invasive, Nonnative Species			X
Migratory Birds			X
Native American Concerns			X
Threatened or Endangered Species			X
Wastes, Hazardous or Solid	X		
Water Resources and Quality			X
Wetlands/Riparian Zones		X	
Wild and Scenic Rivers	X		
Wilderness			X
NOTE:	* Environmental elements determined to be Not Present or Present/Not Affected need not be carried forward or discussed further in the document.		
	** Environmental elements determined to be Present/May Be Affected must be carried forward in the document.		

**Resources Present but Not Affected**

BLM has evaluated the potential impact of the Proposed Action on floodplains and wetland/riparian zones and has determined that, although the resources are present, they would not be affected by the Proposed Action. Rationale for dismissing these resources from further discussion in the document is as follows:

- **Floodplains:** No permanent structures would be built for the proposed project; therefore, there will be no effects to floodplains.
- **Wetland/Riparian Zones:** Although riparian zones may exist within the lease area, none are present within the survey locations. No surveys would be located in riparian or wetland zones.

**Resources Present and Brought Forward for Analysis (Critical and Non-Critical Elements)**

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

- Geology, Soils, and Seismicity
- Water Resources and Water Quality
- Cultural Resources and Native American Concerns
- Biological Resources (Invasive, Non-native Species; Migratory Birds; Threatened and Endangered Species)
- Visual Resources

- Land Use and Recreation
- Traffic and Transportation
- Air Quality
- Noise
- Human Health and Safety and Hazardous Materials
- Socioeconomics and Environmental Justice

## 3.2 Geology and Soils

### 3.2.1 PHYSIOGRAPHY AND TOPOGRAPHY

The project area is located east of the Cascade Range province and west of the Basin and Range province. The Cascade Range is composed principally of rhyolitic to basaltic volcanoes. Local features of the Cascade Range include stratovolcanoes (e.g., Mount Shasta), small cinder cones (e.g., Fourmile Hill), glass flows (e.g., Glass Mountain), and a shield volcano (e.g., Medicine Lake Volcano). Nearby Lassen Peak is one of the recently active volcanoes of the Cascade Range (BLM et al. 1998).

The project area is located in an area identified as the Medicine Lake Highlands, which is located approximately 30 miles northeast of Mount Shasta. The Medicine Lake Highlands is composed primarily of volcanic formations, including cinder cones, caldera basins, craters, lava flows and domes, and a basalt-capped plateau (BLM et al. 1995).

The topography of the project area exhibits relief, with peaks and valleys present throughout. The highest point in the project area is Mt. Hoffman at 7,913 feet above mean sea level (amsl). The elevation of Medicine Lake is 6,676 feet amsl, which is the lowest point in the basin.

### 3.2.2 GEOLOGY

The Medicine Lake Highlands originally formed as the Medicine Lake Volcano, a shield volcano measuring approximately 20 miles in diameter and approximately 2,500 feet in altitude (BLM et al. 1995). It is the largest volcano in the Cascade Range by volume. The volcano has erupted at least 17 times in the past 12,000 years with varying intervals between eruptions. The volcanic shield collapsed approximately 500 feet early in its lifetime, leaving behind the Medicine Lake Caldera at the center of the proposed project area (BLM et al. 1995; Donnelly-Nolan 1990). Recent volcanic activity in the Medicine Lake Highlands has included the eruption of basalt flows, obsidian flows and domes, and pyroclastic pumice (BLM et al 1995).

Historical faulting and venting is evident around Medicine Lake Volcano. Faults and vents are typically oriented north-south or within 30 degrees of north. Fissures associated with the Little Glass Mountain eruption can be found on the northwest slope of Medicine Lake Volcano (Donnelly-Nolan 1990). The crustal extension and the presence of a Cascade Range volcano (Medicine Lake Volcano) are indicative of the combination of the dominant Basin and Range geologic process (i.e., extension) with the dominant Cascade Range geologic processes (i.e., volcanism).

The Calpine lease area contains Quaternary and Pliocene volcanic rocks, glacial deposits from the most recent ice age (Pleistocene), and Holocene alluvium. Most of the proposed survey locations are located on Quaternary Pleistocene volcanic rock. The area also has several Quaternary and Pliocene cinder cones. Figure 3.2-1 is a geologic map of the proposed survey area. Several glass flows and Special Interest Areas (areas with unique characteristics and to be protected for various uses such as education and cultural use) are located within the proposed project area. These are



considered unique geologic features. Lease stipulations or standards and guidelines in Forest plans protect these features from surface occupancy or disturbance. Special Interest Areas are shown on Figure 3.2-1 and include:

- Pumice Craters
- Little Glass Mountain
- Fourmile Hill Tree Molds
- Medicine Lake Glass Flow
- Glass Mountain Glass Flow

#### 3.2.3 SOILS

Soils in the project area are mainly derived from the basalt, andesite tuff, pyroclastic pumice, cinders, and ash. The National Resource Conservation Service (NRCS) has classified the soils in the proposed project area as shown in Figure 3.2-2. A legend for the soil map is provided in Appendix B.

The soil groups that make up the majority of the soils in the area are the Kinzel-Lapine-Divers family associations, as described below:

- **Kinzel Family** consists of very gravelly loamy coarse sand, extremely stony sandy loam, and cemented, extremely cobbly sandy loam.
- **Lapine Family** consists of very gravelly coarse sand, extremely gravelly coarse sand, extremely gravelly sandy loam, all of which overly unweathered bedrock.
- **Divers Family** consists of gravelly sandy loam, very gravelly sand, and extremely cobbly sandy loam, all of which overly unweathered bedrock.

Other soils that are present include:

- **Revit Family** soils consist of fine sandy loam, cobbly fine sandy loam, and extremely stony fine sandy loam, all of which overly unweathered bedrock.
- **Yallani Family** consists of gravelly sandy loam and extremely cobbly sandy loam.
- **Sheld Family** consists of gravelly fine sandy loam, very cobbly loam, and very cobbly sandy loam, all of which overlie unweathered bedrock.

All soil types are fairly loose and are susceptible to erosion.

#### 3.2.4 MINERAL RESOURCES

##### Quarries

The only mineral resources known to exist in the vicinity of the project area, other than the geothermal resources, are a number of small rock quarries used by the USFS as a source of road-building materials and several existing and former pumice mine operations located north of Glass Mountain (BLM et al 1995).

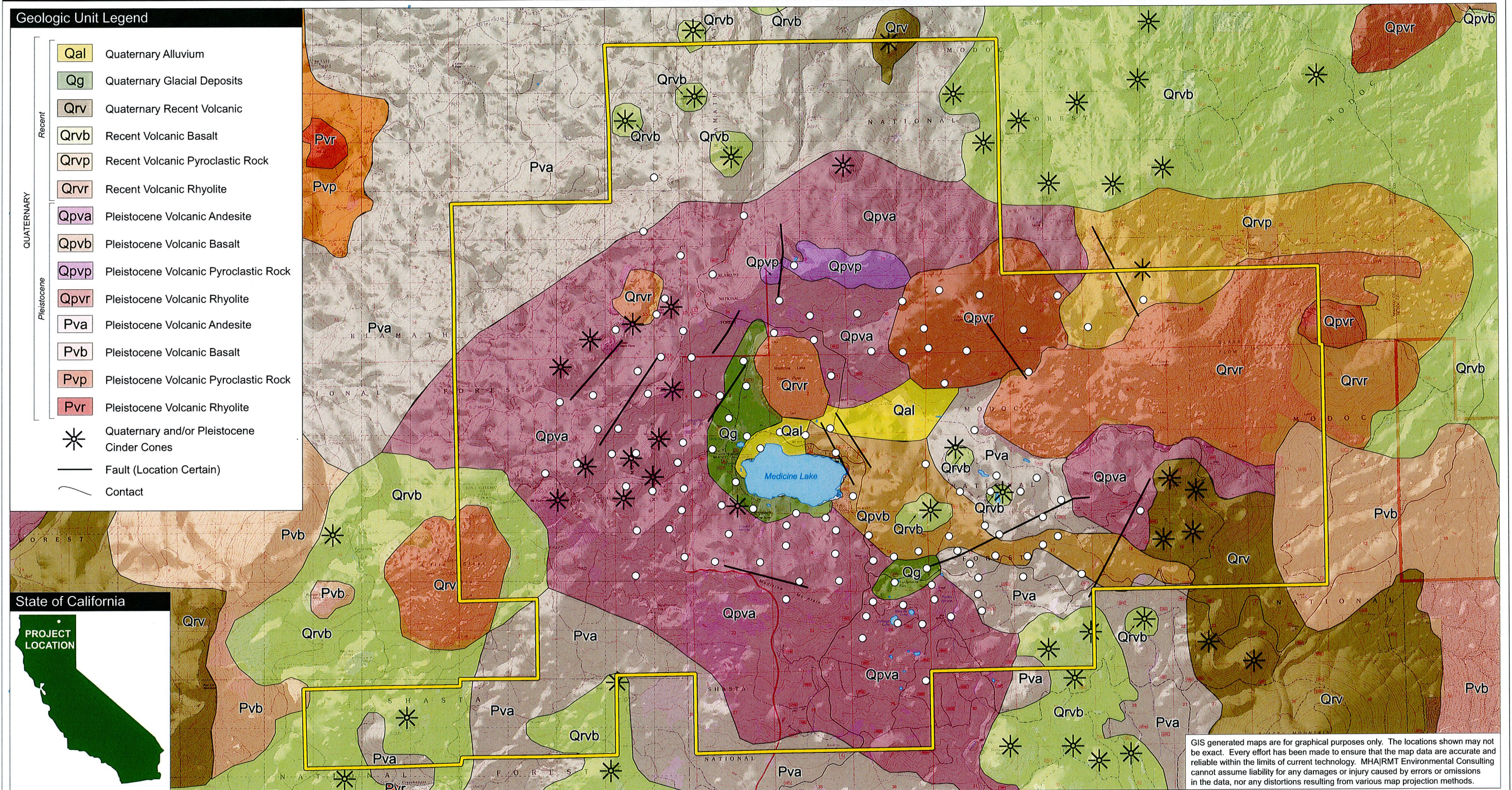
##### Geothermal Resources

A geothermal resource can be defined as a geologic accumulation of thermal energy potentially exploitable for human purposes (Anderson et al. 1998). In order for a geothermal resource to be a viable energy source, the following are required:

- Concentration of heat energy relatively shallow in the earth's crust



Figure 3.2-1: Geologic Units in the Project Area

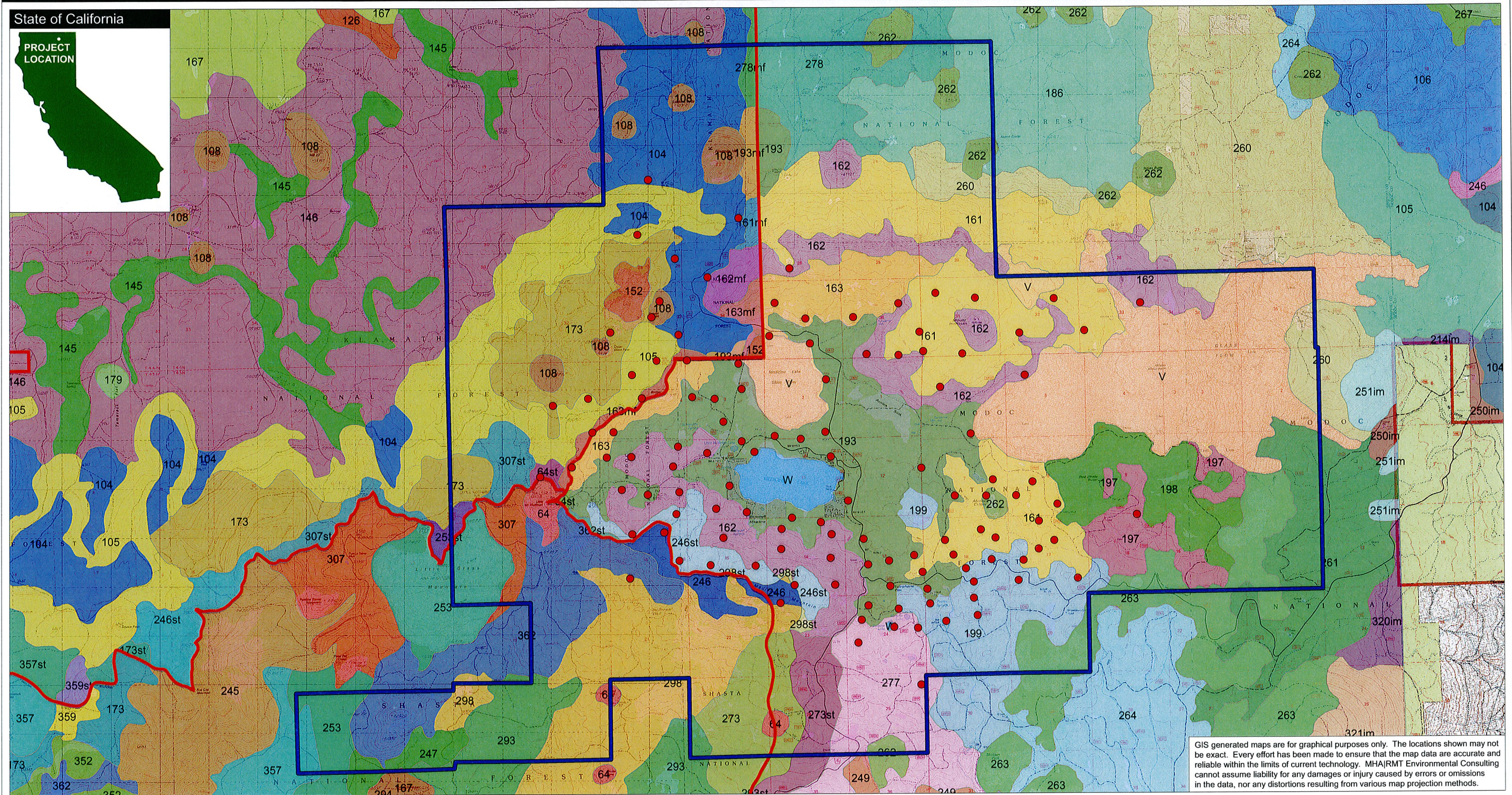


SOURCE: ESRI 2006, California Division of Mines and Geology 1958, USGS 1985, and RMT Inc. 2008





Figure 3.2-2: Soil Map of the Project Area

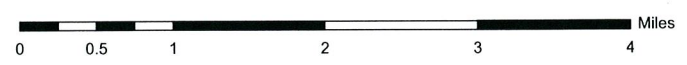


SOURCE: USDA Natural Resources Conservation Service 2008 and RMT Inc. 2008

LEGEND

- Proposed MT-TDEM Station Location (not to scale)
- Calpine Lease Area Boundary
- National Forest Area Boundary

\* Please Refer to Soils Unit Legend in Appendix B





- Steam or hot water to bring the heat to economically drillable depths
- A permeable subsurface geothermal reservoir
- A lithologic and/or hydrothermal alteration cap above the reservoir.

Young volcanism focused along regional fault systems is a common characteristic of productive geothermal resources throughout the world. Similar conditions at the Glass Mountain Known Geothermal Resource Area (KGRA) favor the development of high-temperature hydrothermal systems.

The area extent of the geothermal reservoir depends upon the geometry of the heat source and fractured reservoir volume. The geothermal resource under Glass Mountain is believed to be heated by a small magma chamber.

## 3.3 Water Resources and Water Quality

### 3.3.1 REGIONAL HYDROLOGY

#### Surface Water Hydrology

The Medicine Lake Highlands area is notable for its lack of permanent surface water drainages (except for a few perennial drainages like Paynes Creek). The soils in the project area are very permeable. The hydrologic gradient in the vicinity of the proposed action flows away from the Medicine Lake Volcano and Medicine Lake. The drainage patterns of the project area are discussed in detail in the hydrology Sections of the 1998 Fourmile Hill EIS/EIR and the 1999 Telephone Flat EIS/EIR (BLM et al. 1998; BLM et al. 1999).

Medicine Lake is the largest body of water in the project area (see Figure 1.1-2). Medicine Lake represents the lowest elevation within the volcanic basin, at an elevation of 6,676 feet above mean sea level (amsl). Other surface water bodies within the project area include:

- Little Medicine Lake -elevation 6,682 feet amsl
- Bullseye Lake - elevation 6,735 feet amsl
- Blanche Lake - elevation 6,742 feet amsl

There is also a large dry lakebed known as Arnica Sink, located 1.5 miles east of Medicine Lake at an elevation of 6,696 feet. No geophysical survey activities would be located in Arnica Sink.

There are six springs in the project area as shown in Figure 1.1-2:

- Paynes Springs I, II, and III
- Schonchin Spring
- Crystal Springs
- Unnamed spring

Paynes Springs is the source of Paynes Creek, a perennial creek approximately two miles long. Other streams in the project area are intermittent, only flowing after snowmelt and as intense storm runoff. The proposed project area does not include any Wild and Scenic Rivers.

#### Groundwater Hydrology

The depth to the first major groundwater aquifer is generally 200 feet below ground surface (bgs) within the basin surrounding Medicine Lake (BLM et al. 1995). On the upper flanks of the basin,



the groundwater table is erratic and varies from about 300 feet to 1,000 feet. The groundwater table is approximately 500 feet bgs at the base of the Medicine Lake volcano.

Data from water wells, geothermal wells, and springs in the project vicinity provided information on the groundwater system. Temperature gradient data and lithologic logs from geothermal wells in the area indicate that there are two distinct groundwater systems including a shallow, cold groundwater aquifer and the geothermal system.

### 3.3.2 WATER QUALITY

#### Surface Water Quality

The USFS conducted water quality tests for Medicine Lake in 1971, 1972, 1982, and 1983. The water in Medicine Lake is considered to be of good quality with very good clarity, naturally low nutrient levels, and good buffering<sup>1</sup> capacity. Test results are presented in Table 3.3-1.

Other nearby lakes (e.g., Little Medicine Lake, Bullseye Lake, and Blanche Lake) also have excellent water quality with high clarity and low nutrient levels (Schneider and McFarland 1996). Water quality surveys of these lakes reveal total dissolved solid (TDS) concentrations of 12-24 mg/l (BLM et al. 1999).

#### Groundwater Quality

Medicine Lake is located on the Modoc Plateau, which is in the North Coast Hydrologic Region. The North Coast Hydrologic Region covers all or portions of Modoc, Siskiyou, Del Norte, Trinity, Humboldt, Mendocino, Lake, and Sonoma Counties; therefore, groundwater quality varies throughout the region. The groundwater quality in the Modoc Plateau is generally high in total dissolved solids content and alkalinity because of the influence of lake sediments in the basin (DWR 2003).

**Table 3.3-1: Medicine Lake Water Quality Data<sup>1</sup>**

Parameter	1971-1972	1982	1983
Turbidity	0.14-3.0 JTU <sup>2</sup>	0.3 JTU	0.3 JTU
Secchi Disc Depth <sup>3</sup>	n/a	287 in	307 in
Dissolved Oxygen	8.5 mg/l	7.5 mg/l	7.0 mg/l
Total Phosphorus	0.07 mg/l	0.018 mg/l	0.017 mg/l
Total Alkalinity	<17 mg/l	5.8 mg/l	5.9 mg/l
pH	6.7-7.4	7.4	7.0

<sup>1</sup> Data are from water quality monitoring performed by the USFS in 1971, 1972, 1982, and 1983. Mean values are given unless only a range was reported.

<sup>2</sup> JTU = Jackson Turbidity Units, a measure of turbidity based on the amount of light-scattering caused by the water.

<sup>3</sup> Secchi disc depth is a measure of water clarity.

**SOURCE:** BLM et al. 1998

<sup>1</sup> Buffering capacity is a fluid's ability to maintain a relatively constant pH, even after other constituents are added.

### 3.3.3 CURRENT WATER USES

#### Surface Water Uses

Table 3.3-2 describes current beneficial uses of surface waters in the project area, as defined by the USFS in the RMPs.

Water Body	Domestic Use	Recreation	Fish Habitat
Medicine Lake	√	√	√
Little Medicine Lake		√	√
Bullseye Lake		√	√
Paynes Creek		√	√
Blanche Lake		√	
Schonchin Spring	√		

**SOURCE:** BLM et al. 1998

#### Groundwater Uses

The shallow, cold groundwater aquifer serves as a water supply for the non-geothermal wells in the project area, including those used for domestic supply (BLM et al. 1998).

## 3.4 Cultural Resources and Native American Concerns

### 3.4.1 INTRODUCTION

The proposed action would take place in the Medicine Lake Highlands. The Medicine Lake Highlands formed as a result of numerous and complex volcanic events, with significant eruptions having occurred as recently as a few hundred years ago. The volcanic activity resulted in obsidian deposits that have been used for tool manufacture by Native Americans. The high elevation of the Highlands has seasonally restricted use of this area in both prehistoric and historic times to generally the summer and early fall months.

### 3.4.2 BACKGROUND

#### Cultural Resource Studies in the Project Area

Several cultural resource studies have been conducted in the Medicine Lake Highlands in response to proposed geothermal exploration projects in the area and USFS management activities (such as logging). The Fourmile Hill Geothermal Exploration and Development Projects and the Telephone Flat Geothermal Exploration and Development Projects are the related projects in the vicinity for which extensive cultural resource studies have been completed. Literature research and field surveys were conducted for both study areas.

No new cultural resource field surveys were performed for the proposed project. The reports used to provide information on the study area and to compile this section are listed below. The Memorandum of Agreement between the USFS, BLM, SHPO, and the Advisory Council on Historic Preservation, as amended (2005) and the Medicine Lake Highlands Historic Properties Management Plan (HPMP) were also used and are discussed below.



### 3: AFFECTED ENVIRONMENT

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- *Biological and Cultural Resource Assessments for the Calpine Transmission Line Project*, prepared by S.J. Bianco and D. Sterner for Calpine Corporation, Santa Rosa, CA in 1996 (Bianco et al. 1996)
- *Supplemental Cultural Resources Study for the Calpine Geothermal Project within the Glass Mountain KGRA, Siskiyou County, California*, prepared by T.M. Origer for Calpine Corporation, Inc. Santa Rosa, CA in 1995 (Origer 1995)
- An Archaeological Survey of Potential Temperature Gradient Hole Drilling Sites within the Glass Mountain KGRA, Siskiyou County, California, prepared by T.M. Origer for Calpine Corporation, Inc. Santa Rosa, CA in 1994 (Origer 1994)

Information is incorporated into this cultural resource section by reference from the following documents:

- Fourmile Hill Geothermal Development Project Final EIS/EIR (BLM et al. 1998)
- Fourmile Hill Geothermal Exploration EA/IS (BLM et al. 1995a)
- Telephone Flat Geothermal Development Project Final EIS/EIR (BLM et al. 1999)
- Glass Mountain Unit Geothermal Exploration Project EA/IS (BLM et al. 1995)
- Memorandum of Agreement among the U.S. Department of Agriculture, Forest Service, the U.S. Department of the Interior, Bureau of Land Management, California State Historic Preservation Officer and the Advisory Council on Historic Preservation regarding the Fourmile Hill Geothermal Development Project (USFS et al. 2000, amended 2005)
- Medicine Lake Highlands Historic Properties Management Plan (USFS et al 2008)
- Medicine Lake Highland and Timber Mountain Ethnographic Report for the Fourmile Hill Geothermal Development Project, Siskiyou and Modoc Counties, California (Theodoratus et al. 1998)

#### **Memorandum of Agreement**

The USFS, BLM, SHPO, and the Advisory Council on Historic Preservation (Council) developed a Memorandum of Agreement (MOA) regarding the Fourmile Hill Geothermal Development Project in 2000 and it was amended in 2005 (Appendix C). The MOA stipulates that the following measures are carried out:

- A Historic Properties Management Program (HPMP) for the Medicine Lake Highlands that addresses the need to define cultural values, resolve Traditional Cultural Property (TCP) boundaries, identify methods to protect and enhance cultural values for all projects regardless of whether or not the geothermal development is implemented
- Resolution of project effects on historic properties which is specific to the geothermal development and which outlines measures to ensure environmental effects from the project are addresses
- Administrative stipulations

#### **Historic Properties Management Plan**

The Medicine Lake Highlands HPMP was developed by the USFS (Modoc, Klamath, and Shasta-Trinity National Forests), and the BLM (Alturas Field Office).

The HPMP specifically responded to stipulations of the Fourmile Hill Geothermal Development Project MOA. The USFS and BLM developed the HPMP in consultation with members from the Klamath, Pit River, Siletz, Karuk, and Shasta Tribes, the California SHPO, and the ACHP. California SHPO is responsible for overseeing the agencies' compliance, relative to the MOA, with

the Section 106 and 110 procedures of the National Historic Preservation Act (NHPA, 1992 as amended) and the ACHP serves an advisory role regarding development and implementation of the MOA and HPMP.

The MOA stipulates measures to lessen adverse effects to cultural values resulting from geothermal development in the Highlands. The MOA also stipulates that the HPMP will be implemented whether geothermal resources are developed or not. In accordance with NHPA, the MOA prioritizes the development of the HPMP and highlights issues to be addressed in terms of cultural values, desired future cultural conditions, and mechanisms for the protection of cultural values. For purposes of the HPMP the “Highlands as a Whole”, henceforth referred to as the Central Highlands, will be managed as a National Register Eligible property. This area contains roughly 73,000 acres of public lands and is generally bounded by the 6,000 foot elevation contour<sup>2</sup>.

The Highlands are located within the ancestral territories of the Pit River and Modoc Indians (Klamath Tribes) and represent an area of significant continuing traditional cultural value to several other northern California Indian tribes. The Highlands are valued by Indian communities as a sacred place of healing and renewal. It is also where important traditional resources such as obsidian, water, and medicinal plants are gathered. Medicine Lake, and the volcanic caldera it rests in, contains an interrelated series of locations and natural features associated with American Indian spiritual beliefs and traditional practice. Ethnographic studies, extant physical resources, and contemporary testimony attest to the historic and continuing value of the area for maintaining the Tribes’ traditional cultural identity. Since the early 1900s, the Highlands have also been a very important recreational area to local non-Indian communities who also value the area for its beauty, natural resources and solitude.

The purpose of the HPMP is to:

- Provide an analysis of areas of traditional cultural significance of the Highlands, including an assessment of current conditions vs. desired conditions and recommendations for management and protection of the Highlands area consistent with applicable laws and regulations including but not limited to NHPA and NFMA, AIRFA and the Sacred Sites Executive Order 13007 (1998).
- Define a geographic area of the Highlands if other than the 1999 Medicine Lake Highlands Traditional Cultural Properties District.
- Establish the assessment and HPMP in consultation with Tribes, other Federal, State and local agencies, historic preservation experts including MOA signatory parties, and interested publics.
- Maintain the HPMP as a living document that will be updated as needed.
- Provide guidance for management of the cultural, spiritual and natural resources in the Highlands but it is not a decision document in terms of NEPA decisions or Forest Plan amendments.

Key findings of the HPMP include:

- The Central Highlands is considered the “Area of Traditional Cultural Significance”, eligible for the National Register of Historic Places. It encompasses approximately 73,000 acres of public land and is delineated by the 6000 foot elevation contour in the north, east and west. In the south this area reaches beyond the 6000 foot elevation line into lower elevations to contain the southern portions of the 1999 Medicine Lake Highlands Traditional Cultural Properties District. The Central Highlands reflects the

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<sup>2</sup> In the south the area reaches beyond the 6000 foot elevation contour into lower elevations to contain the southern portions of the 1999 Medicine Lake Highlands Traditional Cultural Properties District.



USFS and BLM best estimation of the area of traditional cultural and religious significance to the Modoc and Pit River people<sup>3</sup>.

- The majority of the cultural management objectives, desired future cultural conditions and cultural management proposals are consistent with the Klamath, Modoc and Shasta-Trinity National Forests Land and Resource Management Plans (LMRP). Management guidelines outlined in Chapter 4 reflect cultural management proposals currently consistent with LMRPs and agency authorities.
- Findings from the Ethnographic Study (Deur 2003), Ethnobotanical (Miller 2004) and Scenic Quality Inventories (Mosier and Joyce 2004), conducted as part of the assessment, provide important information for land managers to consider for future environmental analysis in the Highlands.
- The greatest potential effects to cultural values in the Highlands are related to high wildland fire risks, diminishing structural and biological diversity, geothermal and mineral exploration and development, increasing recreational activities and off highway vehicle use.

Management guidelines and implementation of the HPMP are integrated within the multiple use objectives of the USFS and BLM.

#### 3.4.3 CULTURAL RESOURCE HISTORY

##### Prehistoric Uses

The general vicinity of Medicine Lake provides evidence of at least 11,000 years of human occupation and use of the area. Except for the past 150 years of written history, the only record of this long human history in the area is the oral history of American Indians and the abandoned villages, camps and other remains left by native peoples.

The Medicine Lake area has historically been used by a variety of American Indian groups and tribes, including the Klamath, Modoc, Northern Paiute, Pit River groups, Shasta, and Wintun Tribes. Some of these groups have used the area on a temporary basis to obtain obsidian and other natural resources, while others have had more long-term occupation of the vicinity. All of these groups have rich cultural histories involving lifeways that have been adaptive of the environment. These American Indian groups seasonally occupied various temporary camps, returning to permanent villages in fall and/or winter. They generally returned to the same and seasonally occupied camping spots year after year. Food resources were used on a seasonal basis whenever and wherever they occurred.

Site types found on the National Forests range from winter village complexes to scattered hunting stations, tool manufacturing sites, and plant food processing areas. They also include petroglyphs, pictographs, bedrock mortars, rock shelters, caves, and obsidian and basalt quarries. Of particular importance are the well-known obsidian quarries at Glass Mountain.

The project vicinity offered important obsidian resources to prehistoric populations. Archaeological evidence in the project area indicates that the peak consumption of Medicine Lake Highland obsidian occurred between approximately 3,500 to 1,000 years ago. This evidence is supported by distribution patterns of the same period of Medicine Lake Highland obsidian found throughout prehistoric sites in northern California and southern Oregon. Many of the prehistoric sites recorded in the Medicine Lake Highlands are quarries associated with the obsidian flows. The quarries were heavily exploited for a time, and there is ample evidence of hunting. Further detail on prehistoric resources in the project area is provided in the Fourmile Hill and Telephone Flat Geothermal Development documents listed above.

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<sup>3</sup> The National Register District boundary may be revisited in the future as the HPMP is revised and updated overtime.

## Historic Uses

Modern-day influences on the Medicine Lake Highlands have been largely related to logging and pumice mining after approximately 1920, and contemporary recreational use. Historic themes that dominate many other parts of the State of California such as transportation (e.g., emigrant trails and railroads), water development (e.g., irrigation and flumes), ore mining, and associated settlements, are of little relevance to this area.

During the nineteenth century, Euro-Americans considered the project vicinity to be an area to travel through, or cross, rather than settle (Bunse 1996 in FWARG 1996). Early nineteenth century visitors were primarily explorers and fur trappers. Transportation routes used during this period did not typically cross through the project area.

Railroad building and logging activities were the dominant activity in the project vicinity from the turn of the century until World War II. Railroad building began in the project area slightly before logging developments; logging soon followed in the late 1920s to support railroad construction. In 1932, the Great Northern and Western Pacific Railroads opened their collaborative track connecting Klamath Falls to Keddie, California. This railroad passes through the east end of the project area, west of Tionesta.

Large-scale commercial pumice mining began in the region in the 1930s. Throughout the 1930s and 1940s, pumice from the quarries in the Medicine Lake Highlands was shipped from Tionesta on the Great Northern Railroad.

Modern industrial use of the Medicine Lake Highlands is minor, and has been restricted primarily to railroad development, logging, and pumice mining. This lack of development contributes to the area's current popularity for outdoor recreation (camping, hiking, fishing, hunting, etc.) (BLM et al. 1998).

## Traditional Cultural Values

### Environmental Values

The Medicine Lake Highlands HPMP describes the Modoc (Klamath) and Pit River Tribes values for the proposed project area as well as their desired future conditions for the Highlands. The following is a list of brief definitions for components of the environment, with mention of the desired conditions *in italics*:

- **Air** in the Highlands is valued for its freshness and purity. *Day and night skies are clean* and are not obscured by pollution and other particulates. Air to breathe and smell is fresh and *free of un-natural odors*. Odors from mechanized equipment, vehicles, and other human developments are especially intrusive and adversely impact traditional uses.
- **Water** in the Highlands is valued for its life giving, healing qualities. Traditionalists have referred to water as the lifeblood of the Highlands. Water is fundamental to all traditional practices in the Highlands and because *purity is essential* to waters' medicinal qualities, it should not be contaminated by pollution. Because water is naturally scarce in the Highlands, it is highly regarded and viewed as especially precious.
- **Forest health** is valued for its contribution to the spiritual atmosphere of the Highlands. In essence, forest health means spiritual health. *In a healthy forest, the vegetation is structurally and biologically diverse. Forests contain un-even aged stands and diverse understory communities essential for wildlife habitat, functional riparian zones and traditional plant species.* Forest, or ecosystem, health is a spiritual requirement. If the ecosystem becomes contaminated, then spiritual values are damaged or lost. To the local Indians, natural resources are considered cultural resources; they cannot be separated. Therefore, values associated with natural resources are considered by local Indian communities to be



contributing elements of a sacred landscape as well as a historic property as defined by the National Historic Preservation Act.

In the cultural ecology of the Highlands, the springs, trees, animals, plants, and unique landscape features have a distinct cultural value of their own because of their origin in the Highlands; they are especially valuable as they are considered an expression of the Creator's presence. As such, the botanical and animal species in the Highlands have a higher level of spiritual significance. This means that the traditional practices and lifeways associated with the gathering of food and care of the land become spiritual endeavors. Therefore, in the Indian worldview, environmental impacts are also cultural impacts since values associated with living cultural and social systems are imbedded in the land, plants, animals, air, water, setting, and beauty of place.

- **Sound (natural auditory qualities)** in the Highlands is valued when it conveys the *natural noises of the forest, the wind, and the quietude* needed for prayer, vision, and power seeking. Noise levels should not be distracting or intrusive to the practitioners' heightened level of experience.
- **Viewsheds (and other visual qualities)** as seen from several culturally important buttes and mountain tops in the Highlands are valued for their *unfragmented, powerful volcanic and forested landscape features that extend from horizon to horizon without significant evidence of human development or commercial intrusions*. Practicing traditionalists often orient their activities towards other power features and alignments. *Unobstructed viewsheds, with unobtrusive elements in the intervening landscapes*, are needed in order to connect visually and spiritually from the place one stands to other power places containing unique powers sought by the practitioner. Scarred viewsheds are distracting, may interrupt traditional practices, and may diminish the power of the experience.
- **Traditional uses of and beliefs about the Highlands** are valued because they are central to the identity and survival of the American Indian communities that revere the Highlands. Beliefs and practices associated with the Highlands are derived from origin stories, the passing down of cultural knowledge from generation to generation, as well as an individual's personal spiritual experience. The Highlands, and its center at Medicine Lake, is a legend place. Stories tell how Creator bathed in the lake and created Obsidian people at Glass Mountain. It is believed today that Old Man Creator comes down from Mount Shasta and bathes in Medicine Lake. Creator's spirit is, therefore, imbued in the mountains, buttes, and other natural features throughout the Highlands.

Important cultural teachings are derived from the ancient stories passed down from generation to generation regarding events and spiritual beings associated with the volcanic landscape of the Highlands. Significant events revolve around explanations for geomorphic features and volcanism. For example, the teachings are displayed in the stories about the actions of Creator, Old Man Flint, and Coyote. To go to the Highlands is to get closer to Creator. Local Indians today journey in the Highlands to experience the presence of their ancestors; to see, feel, and experience the same spiritual qualities as the ancient ones did. One goes to the Highlands to leave worries behind. They go to connect to their origins and replenish their spirit. *The natural setting within which traditional practices are conducted should be maintained or managed for conservation or enhancement of cultural qualities.*

- **Spiritual values** in the Highlands are directly tied to the *health of all the components of the ecosystem*. Ecosystem health is critical to maintain spiritual values. The spiritual quality of the Highlands sustains the traditional culture of the communities that revere the Highlands. Currently, spiritual qualities are considered by many tribal members to be nearing their threshold of cultural integrity due to increases in recreational uses, numbers of people, expanded roaded areas, off road motorized uses, and motorized boat use on Medicine Lake. Proposed geothermal developments are believed to "...threaten the collapse of spirit for the area..." (Theodoratus et al 1998).

Cultural preservation in the Highlands means *protecting the spiritual atmosphere of purity and remoteness*. The well-being, or spiritual health of the Highlands, is closely related to the improvement in other areas of tribal life, including physical and psychological health, general

welfare, cultural revitalization, and livelihoods. Because the Highlands serve as a sanctuary, there is a direct link between the health of tribal communities and the spiritual condition of the Highlands as a whole.

- **Relationship to other traditional cultural properties.** Like the Highlands, Mount Shasta, situated approximately 20 miles west of the Highlands, has been determined eligible to the National Register of Historic Places as a Traditional Cultural Property for its association with events that have made a significant contribution to the cultural traditions of a community. Theodoratus et al. (1998) explains that the Pit River people view the Highlands region as a tightly interconnected series of features extending west to Mount Shasta. Geographically, the two places are linked since the Highlands are considered an easterly projection of the Cascade Range into the Modoc Plateau. Beyond this geographical link, the key relationship between Medicine Lake and Mount Shasta lies in legend. Ancient stories tell how Mount Shasta is the “head mountain,” since it is home of Creator. From Mount Shasta, Creator would travel to rest and bathe in Medicine Lake. The *Obsidian People* story links the two places as it tells how Mount Shasta stopped the killing by the Obsidian People who lived at Glass Mountain.

Timber Mountain, Lava Beds, and Dry Lake Beds have all been identified by local Indians as important cultural places. Timber Mountain, located approximately 15 miles northeast of the Highlands, has been determined eligible to the National Register as an archaeological district that demonstrates traditional cultural importance to the Tribes (Gates 1999). Lava Beds, located about 10 miles north of Medicine Lake, and Dry Lake Beds, located about 20 east, are both potentially eligible properties due to their association with historic events (Modoc War) and archaeological values.

The Highlands is connected geophysically to these important places by volcanic events where the high elevation mountains, buttes, glass flows, and cinder cones of the Highlands landscape transition into the lower elevation scablands of the Modoc Plateau. Ethnographic studies (Theodoratus 1998 and Deur 2003) reveal information regarding the linkage of the places in terms of travel routes between destinations. The Highlands are also linked to the Lava Beds as it served as sanctuary to the Indians during the Modoc War. Therefore it is especially important that these cultural places and historic properties be managed in such a way as to protect their archaeological and traditional cultural values.

- **Medicinal and other native plants** are valued for their healing, medicinal, nutritional, and utilitarian qualities. The *health, viability,* and populations are monitored by practitioners as indicators of the overall health of the Highlands ecosystem. Plant and animal life play an important part in both spiritual and cultural significance, for they are not interchangeable with plants or animals found outside the Highlands. In other words, they are especially valued because of their origin in the Highlands.
- **Archaeological research** is not highly valued by the tribes, although recent archaeological investigations have provided important information regarding ancient uses, including trade of obsidian resources, in the Highlands. Generally speaking, archaeological investigation is viewed as exploitive and destructive. The tribal perspective is that *living cultural values should not be compromised by the destruction of cultural sites through excavation* by the scientific community. *Ethnological, ethnohistoric, and ethnographic research and documentation are viewed as important if conducted in a sensitive manner and for reasons that benefit the culture and heritage programs of the tribes.*
- **Specific historic properties** are valued for their unique function and place in the spiritual cosmology of the Highlands. Properties should be managed for protection and enhancement of their cultural values. Impacts from human uses, commercial uses, and development should be minimized.

### Values of Place

The types of places that constitute the District and other cultural places in the Highlands are categorized as Water Places (lakes, springs, creeks and associated riparian areas), High Places



(buttes and mountains), and Unique Geological Features (glass flows, dry meadows over lava flows, and pumice sinks). Intervening areas are also addressed below. Each category of place has similar functions but function may vary with the need of the individual practitioner. Nevertheless, it is believed that all cultural places are connected by the unique power of the Highlands since they often represent different steps and levels along an individual's spiritual journey.

- **Water Places.** Water is valued as the lifeblood. This is because the local Indian worldview sees life as originating from water; pure water gives continuous life. Therefore, water tainted by industrial developments and recreational uses adversely affects the health and healing properties not only for the people but affects the health of the soil, plants, and wildlife as well.

Clean water is the most critical component of ritual and traditional practice in the Highlands. Water is used in bathing and is consumed in the healing ritual and for preparation for personal power and vision quests into the mountains. Water places often function as beginning or ending points in the journey. Some water places may be destination points due to the unique medicinal qualities of the spring or presence of traditional plants. Water in the Highlands is scarce and is therefore especially precious.

Medicine Lake is believed to be the spiritual center of the Highlands and is where the power of the Highlands originates. Local Indian communities go to the lake for medicinal purposes; they drink and bathe in the water for physical and emotional healing.

Traditional camps are located near water sources. Some are used by individuals preparing for vision quests and power seeking in the surrounding mountains. Others serve as family camps while hunting and plant gathering or for ceremonial occasions. Ritual bathing is an important component of all gatherings in the Highlands whether these are motivated by hunting, plant gathering, or specific spiritual endeavors. Traditional camps also provide opportunities for transmitting traditional culture, recounting origin legends, ceremonial revitalization, and reiterating spiritual values and practices. Access to traditional camping places is an important concern to local Indian communities.

Ethnographic information for eight water places was recorded by Theodoratus et al. (1998). Seven are located in the District and are eligible to the National Register as contributing properties.

- **High Places.** High places function as steps to Creator where vision, power, and healing can be attained through prayer and ritual. Special powers for doctoring, hunting, or a variety of different kinds of personal assistance are sought on various mountain and butte tops, where power and medicine are concentrated for these purposes. Certain kinds of medicine and spirit power are associated with different buttes and may be used by practitioners seeking special doctor powers. Others are specifically identified as places for vision quests and for personal spirit guidance. Access to spirit power in these places has to be earned in terms of spiritual preparation and readiness, a preparation that often begins with ritual bathing in one water place. Anyone may use high places to seek personal assistance as needed. Important qualities associated with High Places include natural settings, panoramic views, or visual alignments with other power places, and privacy and solitude during use.
- **Unique Geological Features.** Unique geological features function as the manifestation of the power of Creator and the associated spiritual power of the Highlands. They are valued for their inherent power that is tied to the volcanic and cultural history of the area. As mentioned in previous sections, many of these places are central to legends and traditional teachings and yield important ceremonial and economic resources (obsidian, pumice, plants).
- **Intervening Areas.** Intervening areas between water places, high places, and geological features are important to cultural practices because one must travel through intervening areas to reach spiritual and cultural destinations. Along the way, food, rest, water, and other resources are gathered and used for both religious and subsistence reasons. The condition of the setting or health of the forest is an important part of the experience as it contributes to the overall physical and spiritual well being of the practitioner. If the journey between places is interrupted by significantly altered landscapes, or human intrusions, then the journey is disrupted and the spiritual experience is diminished.

### 3.4.4 REGULATORY FRAMEWORK

#### Overview

Several laws and Executive Orders address the issue of consultation with local American Indian groups regarding any proposed project that may affect traditional religious practices or cultural resources, including:

- National Historic Preservation Act of 1996, as amended
- American Indian Religious Freedom Act of 1978
- Executive Order 13007
- Executive Order 12898
- Native American Graves Protection and Repatriation Act
- National Environmental Policy Act
- California Environmental Quality Act

These federal and state laws and the Executive Order are described in Section 3.6, Traditional Cultural Values of the Fourmile Hill EIS/EIR.

#### National Forest Land and Resource Management Plans

The Klamath, Shasta-Trinity, and Modoc Land and Resource Management Plans (LRMPs) contain forest wide and focused standards and guidelines according to each resource area. Section 3.7 Land Use and Recreation describes each of the relevant portions of the LRMPs. Every proposed project must comply with USFS direction from the resource management plans.

#### Medicine Lake Highlands HPMP

The Medicine Lake Highlands HPMP provides guidance for management of the cultural, spiritual and natural resources in the Highlands but it is not a decision document in terms of NEPA decisions or forest plan amendments. There are some inconsistencies with the HPMP and other legal regulation and the existing forest plans. One key discrepancy is in regard to forest multiple uses. The HPMP raises the issue that geothermal leases should be withdrawn or not renewed upon expiration. The plan recognizes that the withdrawal of geothermal leases is not within BLM authority. As leases expire, BLM can ensure cultural values are considered in deciding whether or not to issue new leases and develop alternatives during environmental analysis that protect or minimize impacts to cultural values. The Forest Service can consider mineral withdrawals of lands that do not have current leases during project NEPA analysis or as an amendment to the forest plan. As plans of operations for pumice mines, and other mineral development, are proposed or renewed, the forest may stipulate mitigation measures to minimize impacts to cultural values.

Where geothermal or mineral leases or permits can not be withdrawn, mitigation of adverse effects from future proposals should, at minimum, model stipulations as defined in Section II, Resolution of Project Effects, of the Fourmile Hill Geothermal Development MOA (2000). The plan suggests that the suggested stipulations be included in the environmental analysis for future proposals, either in the proposed action or in at least one alternative.

The plan requires that agencies acknowledge that *major* energy or mineral development will likely cause adverse effects.



### 3.4.5 NATIVE AMERICAN CONSULTATION AND CONCERNS

#### Overview

The major tribes in the project area include the Pit River Tribe and the Klamath Tribes. Consultation for the proposed project was conducted by the BLM. The Tribes were provided the project scoping materials (in Appendix A) and two meetings were held with the Pit River Tribes. The Klamath Tribes declined consultation.

Consultation for geothermal activities in the Glass Mountain KGRA has an extensive history. Consultations were conducted for the 1998 Fourmile Hill Geothermal Development project and for the 1999 Telephone Flat project. The Klamath Tribes had three primary concerns about project development. These concerns included effects on spiritual uses as described in the American Indian Religious Freedom Act, impacts on ethnobotanical uses, and loss of access to sites. Other concerns included alteration to the natural landscape, visual quality disruption, interference with spiritual solitude, destruction of cultural artifacts, noise pollution, wildlife harassment, wildlife habitat destruction, removal of wildlife from natural ranges or homes, adverse affects to natural groundwater sources, air pollution, damage or removal of ethnobotanical resources, and interruption of other tribal activities (e.g., camping, socializing, and gathering).

Additional consultation and joint efforts resulted in the 2008 Medicine Lake Highlands HPMP. This project was a 5 year effort that included numerous meetings between the USFS, the BLM, and the Tribes. Since there is currently no PA specific to the Highlands in place, the Medicine Lake cultural assessment team drafted the *Interim Guidelines for Addressing Traditional Cultural Values of the Medicine Lake Highlands Relative to Environmental Analysis and Section 106 of the National Historic Preservation Act (2002)* (Appendix D). This interim document serves as a starting point for streamlining the consultation effort.

#### Federal Consultation for the Proposed Project

Formal consultation under Section 106 of the NHPA was conducted by the BLM. The BLM introduced the proposed project in two meetings with the Pit River Tribe. The first meeting was held in Burney, California on June 5, 2008. Calpine's proposal to complete geophysical testing on leased lands in the Medicine Lake Highlands was discussed. Maps depicting the proposed testing locations as well as the geothermal leases themselves were provided. The project was presented again on August 14, 2008. Several concerns were expressed at the August 14<sup>th</sup> meeting:

- **Road Closures.** The first issue related to how recent road closures in the Medicine Lake Highlands would affect Calpine's ability to complete its tests. Laurence Crabtree of the USFS said that Calpine could possibly be given a special use permit to use the roads. The Council asked whether tribal members would also be able to use the roads.
- **Cumulative Effects.** Tribal members said that Calpine has admitted that the geophysical testing will accelerate geothermal development in the Highlands. They said that the EA needs to address cumulative impacts.
- **Water Quality Effects.** Concerns were expressed over the possible impacts of geophysical testing in close proximity springs and lakes and if water quality impacts would occur.
- **Effects to the Forests.** Concern was raised over the potential impacts to forests.
- **Surveying only in Authorized Areas.** Issues were raised regarding previous geophysical surveys conducted in 2002 and 2005 extending beyond authorized areas. The tribes also wanted to understand why more tests were required.
- **Inconsistencies in the Forest Plans.** The Tribe said that inconsistencies in the Forest Plan need to be resolved. The plan acknowledges cultural interests but still allows geothermal development.

- **Litigation Resolution.** With lawsuits pending relative to the Telephone Flat Project, the Tribe thinks it would be prudent to not authorize any further investment in exploration or development until those lawsuits are resolved. The tribes requested that the geophysical testing be postponed until the current litigation is resolved.

Consultation also included the SHPO. The BLM discussed the proposed project with the SHPO on July 16, 2008. The SHPO is finding that the proposed project would have an adverse effect on the Medicine Lake Highlands Traditional Cultural Property, since the survey area falls within the potentially eligible property. Although an adverse effect to the cultural property was identified during the consultation process, the effects have been previously addressed through the Medicine Lake Highlands HPMP and in the Telephone Flat and Fourmile Hill EISs.

### **Additional Consultation**

An additional meeting was held in front of the Pit River Tribal Council on September 12, 2008. The meeting was not part of the formal Section 106 process, but was held as a means to allow the tribe to contribute additional input for the EA analysis. Nine Council members were present and, Michelle Berditchevsky, Tribal EPA Coordinator. Other tribal members were in attendance but did not contribute to the discussion. Dr. Dorothea Theodoratus, and Kathleen McBride M.A., lead the meeting as independent consultants for the BLM.

The purpose of the meeting was explained and the project description presented. The following materials were distributed to each Council Member:

- A map showing the proposed 120 geophysical exploration sites;
- A copy of the BLM letter soliciting comments from "Interested Parties" dated June 12<sup>th</sup> 2008; and
- A Calpine "Notice of Intent" containing the project plan details.

Although the purpose of the meeting was to obtain input on effects and mitigations for the proposed geophysical project, larger concerns about future development and the implications of the geophysical surveys were raised. The consultation report is provided in Appendix E. Concerns over the physical impacts of the proposed surveys were not specified, as the tribes strongly opposed any project related to geothermal development.

## **3.5 Biological Resources**

### **3.5.1 OVERVIEW**

This section outlines the biological resources setting of the proposed project at the proposed survey sites. The vegetation and wildlife of the regional and local project area are described. The regulatory setting, which includes state, federal, and local laws, regulations, and plans, is also discussed in the context of their applicability to the biological resources affected by the proposed project.

### **3.5.2 VEGETATION**

The Medicine Lake Highlands are recognized in the "Ecological Units of California" as a unique subsection of the Southern Cascades Section (USFS 1994). Two main vegetation groups occur south of Medicine Mountain in the Medicine Lake basin. These groups include the High Montane group and the Subalpine group (USFS 2007a; USFS 1994). The northern and southern areas of the Medicine Lake Highlands are populated by the Northern Transition Group and the Mid-



Montane group. The proposed geophysical survey area falls within all four of these groups. Each group is described below.

- **The High Montane group** is found between 6,300 and 7,500 feet in elevation on the northern slopes of buttes and peaks in the Southern Cascades. Red fir and white fir series are the main natural vegetative communities, while the lodgepole pine series is dominant in cooler valleys and basins.
- **The Subalpine group** is found at elevations above 7,000 feet. Mountain hemlock is dominant in the Subalpine group.
- **The Northern Transition group** is found in the northern and southern areas of the Medicine Lake Highlands region. In the north, this group contains ponderosa and lodgepole pine at elevations between 5,600 and 6,400 feet. In the south, the Northern Transition group contains white fir and red fir. White fir occurs alone at elevations between 5,600 and 6,800 feet, while the red fir and white fir grow together in a smaller range from 6,800 to 6,900 feet in elevation. To the east, this group is characterized by lodgepole pine, ponderosa pine, and sugar pine at elevations from 5,200 to 6,200 feet (USFS 2007a).
- **The Mid-Montane group** includes eastside mixed conifer series, eastside pine series, and the pine/juniper series make up the Mid-Montane Group. Ponderosa pine, white fir, sugar pine, and incense cedar occur from 5,000 to 6,000 feet in elevation. Usually, two species shared dominance (USFS 2007a).

Various general herbaceous communities are found within the proposed project area within the Medicine Lake Highlands. Meadow barley (*Hordeum brachyantherum*), baltic rush (*Juncus balticus*), primrose monkey flower (*Mimulus primuloides*), great basin clover (*Trifolium longipes*), and western aster (*Aster occidentalis*) are identifying species of wet meadows, found at elevations between 6,300 and 6,900 feet. Dry meadows are dominated by the western needlegrass-pussytoes association, which occurs locally within white fir and lodgepole series between 5,800 and 6,800 feet in elevation. Grasses in these areas are typically western needlegrass (*Achnatherum occidentale*), pine woods pussytoes (*Anetnnaria geyeri*), and onion grass (*Melica bulbosa*) (USFS 2007a).

Pumice flats, generally at the low points of the Medicine Lake caldera, are typically vegetated by the Marumleaf buckwheat –pussy paws association. The rhyolitic pumice creates a highly-acidic environment, in which very few plants can exist. Plants found on the pumice flats include Marumleaf puckwheat (*Eriogonum marifolium*), pussy paws (*Calyptridium umbellatum*), dwarf lupine (*Lupinus lepidus*), Parry's rush (*Juncus parryi*), and California aster (*Lessingia filaginifolia*) (BLM 2007). For the most part, lava flows, especially the most recent, are typically void of vegetation (USFS 1994).

### 3.5.3 WILDLIFE

#### Overview

The proposed project site occupies land in three national forests: Klamath National Forest (approximately 21 percent of the lease area), Modoc National Forest (approximately 63 percent of the lease area), and Shasta-Trinity National Forest (approximately 21 percent of the lease area). Most of the land is part of the Modoc National Forest, which is home to more than 300 animal species (USFS 2006).

#### Key Game Species

The southern Cascade region has several important mammalian and avian game species. Executive Order 13443, Facilitation of Hunting Heritage and Wildlife Conservation, signed August

16, 2007, require that these species be considered on federally managed lands. Table 3.5-1 lists the potential game species that are considered under EO 13443 and their potential for occurrence.

### Wildlife Habitat

The Medicine Lake Highlands provide habitat for a number of bird and mammal species that live in coniferous forests. However, species richness is less than many other montane areas in northern California. The soils are nearly dry during the summer due to the low water-holding capacity of the loose volcanic soils. The shrub and herbaceous layers are sparse as a result. There is little surface water, few permanent streams or riparian habitats, and few springs, meadows, or wetlands. Because of the relative lack of aquatic habitats, amphibian species richness is low. Few reptile species inhabit the area because of generally cool temperatures and the short snow-free season. Timber harvest has affected much of the forest habitat of the Medicine Lake Highlands, so that there is little undisturbed late successional or mature forest. The largest single block of unharvested forest covers much of the upper slopes of Mt. Hoffman. Medicine Lake and smaller lakes to the southeast are important surface waters that provide habitat for birds requiring open water for foraging (USFS et al. 1998).

**Table 3.5-1: Range of Habitat for Key Great Basin Games Species**

Common Name	Scientific Name	Description of Habitat/Occurrence Areas	Within Species Range
<b>Mammals</b>			
Bighorn sheep	<i>Ovis canadensis</i>	Bighorn sheep prefer open habitats with adjacent steep rocky areas for escape and safety.	No
Black bear	<i>Ursus americanus</i>	Black bears occupy various types of habitat, but prefer forest areas with a diversity of food choices. Bears prefer dry areas for dens, but prefer to be close to a water body.	Yes
Elk	<i>Cervus canadensis</i>	Elk are common to northeastern California. They feed on grasses and forbs.	Yes
Mountain lion	<i>Puma concolor browni</i>	Mountain lions prefer dense cover or rocky, rugged terrain, but also occur in desert areas. Two of the most important components of lion habitat are a source of meat and cover for hunting.	Yes
Mule deer	<i>Odocoileus hemionus</i>	Mule deer graze on grasses and forbs.	Yes
Pronghorn antelope	<i>Antilocapra americana</i>	Pronghorn antelope typically need open spaces with good forb and shrub availability. Over 150 different species of grasses, forbs, and browse plants are eaten by antelope, which allows them to occupy a variety of habitat types.	Yes
<b>Avian Species</b>			
California quail	<i>Callipepla californica</i>	California quail can tolerate dry habitats and feed on flowers, new growth on shrubs, and insects found in shrub lands.	Yes
Mountain quail	<i>Oreortyx pictus</i>	Mountain quail live in high altitudes where they can be found in grasslands, brush and in open country. They prefer steep slopes with trees and brush for cover.	Yes
Sage grouse	<i>Centrocercus urophasianus</i>	Sage grouse are found in foothills, plains and mountain slopes where sagebrush is present, or in mixture of sagebrush, meadows, and aspen in close proximity.	No
Wild turkey	<i>Meleagris gallopavo</i>	Wild turkey occurs within woodlands and riparian habitats.	No

**SOURCE:** CDFG 2006, CDFG 2008D



The few forest stands in the Medicine Lake Highlands with late successional characteristics, such as high canopy closure and large tree diameter, provide favorable habitat for a number of species of birds and mammals. Special habitat features such as large lava flows, cliffs, caves, rock outcrops, large defective trees, and large snags also are important for many wildlife species (USFS et al. 1998).

### **3.5.4 MIGRATORY BIRDS**

#### **Overview**

On January 11, 2001, President Clinton signed Executive Order 13186, Land Bird Strategic Allotment, placing emphasis on conservation and management of migratory birds. Migratory birds, in general are not protected under the Endangered Species Act, but most are protected under the Migratory Bird Treaty Act of 1918. The Migratory Bird Treaty Act of 1918 decreed that all migratory birds and their parts (including eggs, nests, and feathers) are fully protected under federal law.

Avian species that are known to occur, or may occur, in the project area include the northern spotted owl, northern goshawk, willow flycatcher, peregrine falcon, great gray owl, and the bald eagle (USFS 2008).

### **3.5.5 THREATENED, ENDANGERED, PROPOSED FOR LISTING, AND CANDIDATE SPECIES AND OTHER SPECIAL STATUS SPECIES**

#### **Listing Status**

Special status species discussed in this section include:

- Federal endangered, threatened, proposed, and candidate species
- California endangered, threatened, and rare species
- US Forest Service (USFS) sensitive and watch list plants
- California Natural Diversity Database (CNDDDB) listed plants

The BLM generates a list of sensitive species that may occur on lands managed by the BLM. Since the BLM does not actually manage the surface lands in the area of the proposed lease, BLM species lists are not applicable. The USFS is the surface land management agency and therefore their list of sensitive species was used for the proposed project.

#### **Special Status Plant Species**

Plants in Table 3.5-2 were listed in federal or state lists, or as sensitive plants by the USFS. Plants included in the table were only those found in the five quadrants found in the proposed project area, as listed in the CNPS Inventory of Rare and Endangered Plants. The five quadrants queried were: Schonchin Butte, Little Glass Mountain, Medicine Lake, Bonita Butte, and West of Kephart. If the sensitive plant in question did not occur in these quadrants, or occur in the area surrounding these quadrants, the plant was excluded from Table 3.5-2. NatureServe.org was also queried. If the plant did not occur in Siskiyou County, it was excluded from Table 3.5-2. Complete lists of sensitive plant species for the Shasta-Trinity, Klamath, and Modoc National Forests can be found in Appendix F.

#### **Special Status Wildlife Species**

Extensive surveys for wildlife species have been conducted in the surrounding region (BLM et al. 1995a, 1998). More detailed descriptions of the local wildlife species in the project area are contained in the Fourmile Hill environmental documents (e.g., BLM et al. 1995a, 1998, MHA 1999, Siskiyou County 2001).

**Table 3.5-2: Special Status Plant Species with Potential to Occur in the Project Region**

Common Name (Scientific Name)	Listing Status	Habitat	Potential to Occur Onsite
<b>Vascular</b>			
Clustered lady's-slipper ( <i>Cypripedium fasciculatum</i> )	Federal: None State: None CNPS List: 4.2 USFS: Sensitive	Lower montane coniferous forest. Usually occurs on serpentinite seeps and stream banks.	Low
Talus collomia ( <i>Collomia larsenii</i> )	Federal: None State: None CNPS List: 2.2 USFS: Sensitive	Alpine boulder and rock fields, closed-cone coniferous forests, and volcanic talus.	Moderate
Pyrola-leaved buckwheat ( <i>Eriogonum pyrolifolium</i> var. <i>pyrolifolium</i> )	Federal: None State: None CNPS List: 2.3 USFS: None	Alpine boulder and rock field. In sandy, gravelly, or pumice rock.	High
Little hulsea ( <i>Hulsea nana</i> )	Federal: None State: None CNPS List: 2.3 USFS: None	Alpine boulder and rock field. In rocky, volcanic gravel.	High
Oregon sedge ( <i>Carex halliana</i> )	Federal: None State: None CNPS List: 2.3 USFS: None	Meadows and seeps, subalpine coniferous forest, and pinyon or juniper woodland. Frequently on pumice.	High
Snow fleabane daisy ( <i>Trimorpha acris</i> var. <i>debilis</i> )	Federal: None State: None CNPS List: 2.3 USFS: None	Alpine boulder and rock fields. Meadows and seeps. Subalpine coniferous forest. On volcanic, rocky substrate.	High
Boggs Lake hedge-hyssop ( <i>Gratiola heterosepala</i> )	Federal: None State: Endangered CNPS List: 1B.2 USFS: None	Marshes, swamps, and vernal pools.	Low
Doublet ( <i>Dimeresia howellii</i> )	Federal: None State: None CNPS List: 2.3 USFS: None	Pinyon or juniper woodland. Lower montane coniferous forests.	High
Slender Orcutt grass ( <i>Orcuttia tenuis</i> )	Federal: Threatened State: Endangered CNPS List: 1B.1 USFS: Sensitive	Vernal pools.	Very low
Mountain lady's-slipper ( <i>Cypripedium montanum</i> )	Federal: None State: None CNPS List: 4.2 USFS: Sensitive	Cismontane woodland. Lower montane coniferous forest.	Low
Ephemeral monkeyflower ( <i>Mimulus evansecens</i> )	Federal: None State: None CNPS List: 1B.2 USFS: Sensitive	Lower montane coniferous forest. Pinyon and juniper woodland.	Moderate
Columbia yellow-cress ( <i>Rorippa columbiae</i> )	Federal: None State: None CNPS List: 1B.2 USFS: Sensitive	Pinyon and juniper woodland. Vernal pools. Meadows and seeps.	Low
<b>Non-Vascular</b>			
Threeranked humpmoss ( <i>Meesia triquetra</i> )	Federal: None State: None CNPS List: 4.2 USFS: Sensitive	Bogs and fens. Meadows and seeps. Upper montane coniferous forest.	Very low
Pacific fuzzwort ( <i>Ptilidium californicum</i> )	Federal: None State: None CNPS List: None USFS: Sensitive	Frequently found in dry tundra and mountain tops. Also in coniferous, deciduous, and mixed forests.	Very low



**Table 3.5-2 (Continued): Special Status Plant Species with Potential to Occur in the Project Region**

Common Name (Scientific Name)	Listing Status	Habitat	Potential to Occur Onsite
<b>Non-Vascular</b>			
Threeranked humpmoss ( <i>Meesia triquetra</i> )	Federal: None State: None CNPS List: 4.2 USFS: Sensitive	Bogs and fens. Meadows and seeps. Upper montane coniferous forest.	Very low
Pacific fuzzwort ( <i>Ptilidium californicum</i> )	Federal: None State: None CNPS List: None USFS: Sensitive	Frequently found in dry tundra and mountain tops. Also in coniferous, deciduous, and mixed forests.	Very low
Blandow's bog moss ( <i>Helodium blandowii</i> )	Federal: None State: None CNPS List: 2.3 USFS: Sensitive	Meadows and seeps. Subalpine coniferous forest. On damp soils.	Very low
Threeranked humpmoss ( <i>Meesia triquetra</i> )	Federal: None State: None CNPS List: 4.2 USFS: Sensitive	Upper montane coniferous forest. Meadows and seeps. Bogs and fens.	Very low
Broadnerved humpmoss ( <i>Meesia uliginosa</i> )	Federal: None State: None CNPS List: 2.2 USFS: Sensitive	Upper montane coniferous forest. Meadows and seeps. On damp soils.	Very low

**SOURCE:** USFS 2006, CNPS 2008, NatureServe.org 2007, Leonardi 2002

Additional information on special status wildlife species that are known to occur in the project area is available in the *Modoc National Forest Land and Resource Management Plan – Final Environmental Impact Statement* (USFS 2001) and *Klamath National Forest Land and Resource Management Plan - Final Environmental Impact Statement* (USFS 1995).

Table 3.5-3 lists the special status wildlife with potential to occur within the project area. The table also addresses the species' potential to occur within the proposed survey areas. No aquatic species would occur within survey areas since the surveys would not include any aquatic areas. Species that could occur on-site are described in greater detail in Appendix G. Appendix G also includes a complete table of all potential special status species that may occur in the Medicine Lake Highlands.

**3.5.6 INVASIVE, NONNATIVE SPECIES**

The County of Siskiyou maintains a list of noxious weed species. These weed species are listed in Appendix H. The highest priority weeds for treatment are knapweeds (*Centaurea maculosa*, *Centaurea diffusa*, *Centaurea virgata var. squarrosa*, and *Centaurea jacea nigra*), leafy spurge (*Euphorbia esula*), and Dalmation toadflax (*Linaria damatica*). The infestations of these invasive species are small in number and area (hundreds of total acres or less). Eradication of these species is the goal of noxious weed management plans (USFS 2007b). These species likely occur within the project area.

Key avenues for the spread of invasive species include roads. The disturbed soils and potential for seed distribution via passing vehicles or people create an ideal way for noxious weeds to expand their habitat. Other anthropogenic means of spreading include mining and logging. However, noxious weeds can also spread due to natural processes and disturbances. Natural means of propagation include fires, floods, and wind (USFS 2007b).

**Table 3.5-3: Special Status Wildlife Species with Potential to Occur in the Project Area**

Common Name ( <i>Scientific Name</i> )	Listing Status	Habitat	Potential to Occur on Site
<b>Birds</b>			
Northern spotted owl ( <i>Strix occidentalis caurina</i> )	Federal: Threatened State: Not listed State Rank: S2S3 USFS: Not listed	Typically old growth forests with large trees and large amounts of woody debris on ground.	Moderate
Yellow-billed cuckoo ( <i>Coccyzus americanus occidentalis</i> )	Federal: Candidate State: Endangered State Rank: S1 USFS: Not listed	Riparian woodlands of greater than 40 hectares	None
Bald eagle ( <i>Haliaeetus leucocephalus</i> )	Federal: Not listed State: Endangered State Rank: S2 USFS: Sensitive	Prefers large, accessible trees. Breeding habitat is within 4 km of bodies of water.	High
Northern goshawk ( <i>Accipiter gentilis</i> )	Federal: Not listed State: Not listed State Rank: S3 USFS: Sensitive	Nests in coniferous and mixed forests of mature or old growth, including hemlock and fir species.	High
Swainson's hawk ( <i>Buteo swainsoni</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Savanna, open pine-oak woodland and cultivated lands with scattered trees. Typically nests in a solitary tree.	Moderate
Willow flycatcher ( <i>Empidonax traillii</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Mountain meadows.	Moderate
Greater sandhill crane ( <i>Grus Canadensis tabida</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Grassland and riparian.	None
Great gray owl ( <i>Strix nebulosa</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Dense coniferous and hardwood forest, especially near water.	Very low
<b>Mammals</b>			
Fisher ( <i>Martes pennanti</i> )	Federal: Candidate State: Not listed State Rank: S2S3 USFS: Not listed	Mid- to low-elevation, dense coniferous, mixed, and deciduous forests. Avoids areas with human activity.	Moderate
Sierra Nevada red fox ( <i>Vulpes vulpes nicator</i> )	Federal: Not listed State: Threatened State Rank: S1 USFS: Sensitive	Red fir and lodgepole pine forests. Hunts in clearings and rocky areas.	High
Taylor pika ( <i>Ochotona princeps taylori</i> )	Federal: Not listed State: Not listed State Rank: S2S4 USFS: Not listed	Dark-colored lava fields at 5,000-9,000 feet in elevation. In areas with adequate cover and talus rock.	High
American marten ( <i>Martes Americana</i> )	Federal: Not listed State: Not listed State Rank: S3S4 USFS: Sensitive	Dense deciduous, mixed, or coniferous forest. Also forested wetland.	High
Western mastiff bat ( <i>Eumops perotis californicus</i> )	Federal: Not listed State: Not listed State Rank: S3 USFS: Not listed	Roosts in areas high above ground on sides of cliffs and in rocky crevices.	Low
Western mastiff bat ( <i>Eumops perotis californicus</i> )	Federal: Not listed State: Not listed State Rank: S3 USFS: Not listed	Roosts in areas high above ground on sides of cliffs and in rocky crevices.	Low



**Table 3.5-3 (Continued): Special Status Wildlife Species with Potential to Occur in the Project Area**

Common Name (Scientific Name)	Listing Status	Habitat	Potential to Occur Onsite
Long-eared myotis ( <i>Myotis evotis</i> )	Federal: Not listed State: Not listed State Rank: S4 USFS: Not listed	Forested areas with rocky outcrops. Also shrublands and along streams. Roosts in crevices in trees and caves.	High
Silver-haired bat ( <i>Lasionycteris noctivagans</i> )	Federal: Not listed State: Not listed State Rank: S3S4 USFS: Not listed	Forested areas near lakes and streams. Also roosts in trees, but rarely in caves.	High
Pallid bat ( <i>Antrozous pallidus</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Dry grasslands near rock outcrops. Roosts in buildings, rock crevices, or under bridges.	High
Townsend's big-eared bat ( <i>Corynorhinus townsendii</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Lava tubes, coniferous and deciduous forests. Avoids grasslands as much as possible	Moderate
Pacific fisher ( <i>Martes pennanti pacifica</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Mature forests with high multiple-layer canopy closure, large trees and woody debris.	Low

**SOURCE:** USFWS 2007; NatureServe.org 2007; CADFG 2008a; CADFG 2008b; CADFG 2008c, USFS 2007a, COSEWIC 2006, BiologicalDiversity.org 2008, Lewis 2008, Bay Science 2007

## 3.6 Visual Resources

### 3.6.1 REGIONAL VISUAL SETTING

The project study area can be viewed from the town of Merrill, Oregon, to the north, portions of the Butte Valley to the west, and Tionesta to the east. The vicinity of the proposed survey area is characterized by a diversity of distinct land forms and vegetation that is relatively undisturbed by manmade features.

The primary human influence on the visual landscape in the immediate vicinity of the proposed action has been through geothermal activity, timber harvesting, and recreation. Geothermal activities have resulted in the clearing of well pads. Logging activities have resulted in cleared areas throughout the vicinity of the proposed action, though the area remains heavily forested. Recreational activities have resulted in the establishment of campgrounds, summer cabins, and support facilities, which are visible primarily near Medicine Lake.

### 3.6.2 LOCAL VISUAL SETTING

#### Overview

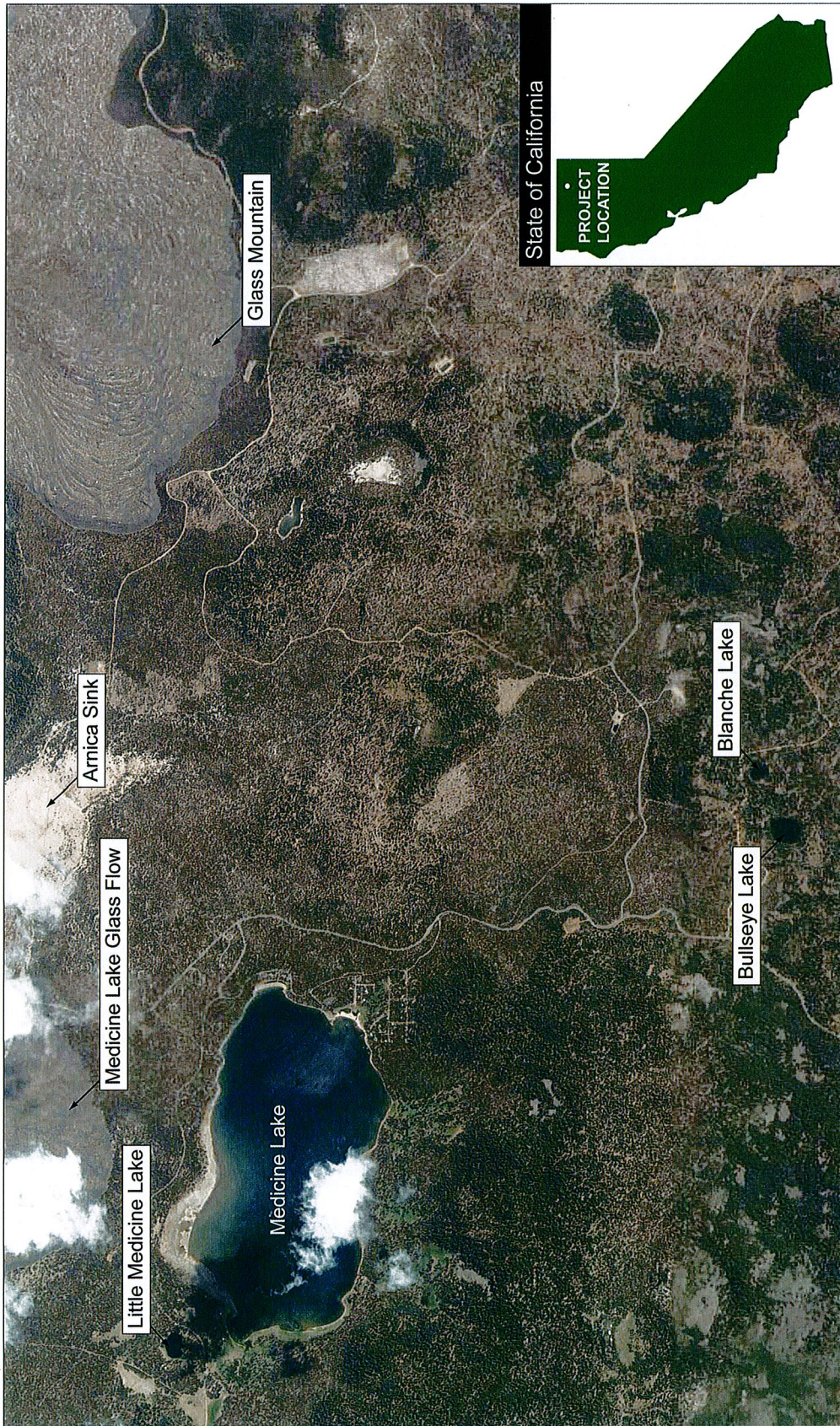
The project region includes two landscapes (see Figure 3.6-1), each with its own landscape character, degree of distinctiveness and integrity, and sense of place. These landscapes include the Medicine Lake Volcanic Caldera and the Medicine Lake Highlands. There is one Scenic Byway and two highways eligible for Scenic Highway designation. The USFS also uses a Visual Management System in the project area, described further in Section 3.6.5.

#### Medicine Lake Volcanic Caldera

The Medicine Lake Volcanic Caldera is a visually-contained basin delineated by a ring of ridgelines and mountain tops that include:



Figure 3.6-1: Landscape Around Project Area



SOURCE: Google Earth Pro 2008 and RMT Inc. 2008

**LEGEND**





- Mt. Hoffman to the northeast;
- Glass Mountain to the east;
- Medicine Mountain to the south; and
- Little Mt. Hoffman, Badger Peak, and Grouse Hill to the west.

The tree canopy within the Caldera consists mostly of lodgepole pine and is soft-textured and fairly uniform in height (about 45 feet). The forest of the Caldera is distinctively punctuated by the waters of Medicine Lake and Little Medicine Lake, the open flats of the Arnica sink, the treeless landscape of the Medicine Lake Lava Flow, and a variety of small open meadow areas (see Figure 3.6-1). Except for these natural features, vegetation density prevents most on-the-ground views from extending beyond the immediate foreground (BLM et al. 2002).

Developed land uses and land modifications are not readily visually evident. Development is generally limited to the forest road system and scattered geothermal land test well pads, which are not visually evident unless they are located in the visual foreground.

#### **Medicine Lake Highlands**

The Medicine Lake Highlands is a broad, fairly evenly sloping uplift in the surrounding landscape that encompasses the Medicine Lake Caldera. Glass Mountain, Glass Mountain Lava Flow (which is void of vegetation), and numerous small volcanic buttes and cinder cones that dot the mountain's slopes are the most prominent natural features in the Highlands (BLM et al. 2002).

#### **Scenic Byways and Highways**

Primary Forest Route 49 is designated as the Modoc Volcanic Scenic Byway from Medicine Lake, north to the Lava Beds National Monument. This designation reflects the generally high visual quality of the route corridor and is used not only to attract forest visitors to the route, but also to inform and demonstrate forest management activities that occur along the way. A Scenic Byway designation does not include any specific regulatory restrictions or management activities. However, visual quality objectives and other forest land use restrictions that may guide management activities would apply to this scenic byway.

State Highways 97 and 139 are within the Master Plan of state highways eligible for official Scenic Highway designation by the State of California. However, neither has been officially designated as a Scenic Highway Route. Highway 139 is recognized in the Modoc County General Plan as a scenic highway corridor. The intent of this recognition is to, in conjunction with historic place designations, increase tourist-related travel through the County and to protect existing scenic resources from incompatible uses (e.g., billboards).

#### **3.6.3 SENSITIVE RECEPTORS**

Sensitive receptors in the proposed project area include visitors to the Medicine Lake Highlands. The area is used for recreational purposes, and is a popular location for camping, sightseeing, swimming, and fishing. Native Americans visiting the traditional cultural use areas are also considered sensitive receptors. Cultural use, including viewsheds of sacred sites, is further discussed in Section 3.4 Cultural Resources and Native American Values.

#### **3.6.4 USFS VISUAL MANAGEMENT SYSTEM**

When NEPA was enacted, it required all federal agencies to manage and perpetuate scenic environments, as well as develop methods and procedures to evaluate and manage qualitative elements of the natural environment. The proposed project is subject to approval from the BLM as the geothermal leasing agents; however, the project would be implemented on USFS managed

lands. The project must therefore conform to USFS management requirements. The USFS utilizes a Visual Management System. This system treats the visual landscape as a basic resource, and is treated as an essential component of USFS lands equal to other basic resources (Henley and Hunsaker 1979).

The basis of the system is the theory that all landscapes are describable and identifiable in objective terms. Geologic and geomorphic formations, as well as vegetative cover, water bodies, and water courses are the basis of the system. The Visual Management System also takes into account the social value of certain landscapes, based on if the landscape is viewed by the public, the amount of people looking at the landscape, and how far the landscape is from the viewer (Henley and Hunsaker 1979).

Lands are rated in a system of several Visual Quality Objectives (VQOs), which dictate alteration of landscapes, as well as a time frame in which landscapes should be rehabilitated to their original state. Lands within the Calpine lease area boundary are classified as follows (Bacon 1979; USFS 2004):

- **Preservation.** Only ecological changes are allowed. Only very low visual-impact recreation facilities are allowed. Other management activities are prohibited.
- **Retention.** Management activities of landscape and landform alterations must not be visually evident. Alterations may only repeat the frequently-occurring natural landscape characteristics. Changes in any aspect, such as intensity, direction, or pattern, should not be evident. Contrasts in form, line, color, and texture must be immediately reduced.
- **Partial Retention.** Management activities of landscape and landform alterations must remain visually subordinate to the characteristic landscape. Activities may repeat form, line, texture, and color that are common to the visual character; however, alterations in other characteristics must be visually subordinate. Aspects of form, line, color, and texture that are not typical of the landscape may be introduced; however, they should remain subordinate to the visual strength of the characteristic landscape. Contrasts in form, line, color, and texture must be reduced to meet partial retention as soon after completion as possible, or within one year.
- **Modification.** Management activities of landscape and landform alterations may visually dominate the natural characteristic landscape. Landform and vegetative alterations must borrow from natural landscape characteristics at a scale that is consistent with natural occurrences. Additional parts of activities, such as roads and root wads, must be visually subordinate to the proposed landscape. Facilities must borrow from the natural landscape characteristics in area of form, line, color, and texture to aid visual compatibility with natural surroundings. Contrasts in form, line, color, and texture should be reduced within one year to meet modification, or should meet regional guidelines.
- **Maximum Modification.** Management activities of landscape and landform alterations may dominate the characteristic landscape. When viewed as background, visual characteristics must appear natural. As foreground or middleground, they may deviate from the natural visual characteristics; scale and detail of alterations may be incongruent with natural visual characteristics. Contrasts in form, line, color, and texture must be reduced within five years of completion.

Most proposed survey sites are located on lands designated as “Partial Retention”. There are no proposed surveys located on lands designated as “Maximum Modification.” The lease areas fall within a management area that must retain a dominantly natural appearance, with little or no visual disturbance. There are special requirements for areas that are part of a viewshed from sacred Native American locations (Mosier pers. comm. 2008). These are further discussed in Section 3.4 Cultural Resources and Native American Concerns. Figure 3.6-2 shows the survey locations in relation to VQO designations.



## 3.7 Land Use and Recreation

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### 3.7.1 LAND USE

#### Regional Land Uses

The project region has relatively sparse human habitation, and there has been relatively little development. Small communities, towns, and homesteads are scattered throughout the region. Land uses in the region consist mainly of a variety of recreational and other forest-related uses, such as selective timber harvesting, grazing, geothermal exploration, and mining.

The proposed project area is located within the boundaries of the non-urbanized and undeveloped Klamath, Modoc, and Shasta-Trinity National Forests. The inaccessibility of the region due to snow during winter months limits the land uses in the project area.

The proposed project would be located in areas where commercial timber operations have occurred on forest lands. As of September 2008, no logging activity is currently occurring and no timber sales are pending within the Calpine lease area in Modoc National Forest (Schoeppach 2008). Roadside hazard removal, such as clearing dead vegetation, is planned for the Modoc National Forest in 2010 (Schoeppach pers. comm. 2008). A timber sale is planned for 2010 in the Shasta-Trinity National Forest (Poehmann pers. comm. 2008). The Hi-Grouse project, which includes a timber sale component, is scheduled to have a Record of Decision issued in 2010 by the Klamath National Forest (Barnum pers. comm. 2008).

Recreation activities are also popular in the proposed project vicinity with Medicine Lake and the Lava Beds National Monument located approximately 3 miles northeast of the project area. The closest population centers are in Tennant and Tionesta (approximately 15 miles each from the project area).

The majority of land in the project region is public land within the Klamath, Shasta-Trinity, and Modoc National Forests. However, private land in-holdings occur in areas on the south shore of Medicine Lake (BLM et al. 1998). No surveys would be conducted on privately-owned lands.

#### Geothermal Exploration and Development

##### Overview

There is an identified geothermal potential in the project region. The geothermal potential of the area has been acknowledged by the designation of the Glass Mountain KGRA, which covers approximately 161,000 acres of land within the Modoc, Klamath, and Shasta-Trinity National Forests. The Calpine lease area is entirely within the KGRA, as shown in Figure 1.1-1.

To date, only geothermal exploration activities have occurred at this KGRA, and no geothermal development has occurred. At least nine geothermal wells have been drilled for the purposes of geothermal exploration.

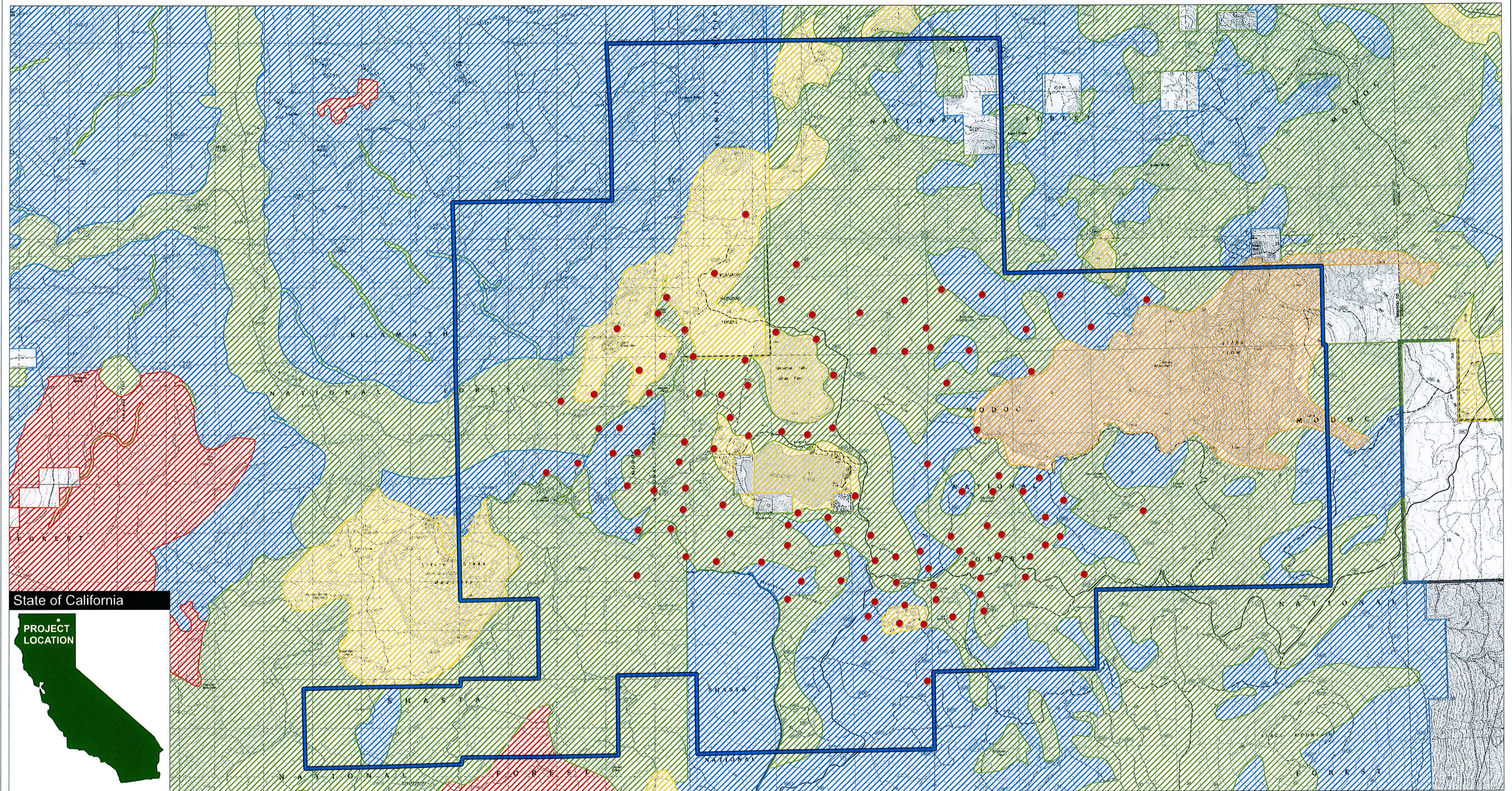
##### Lease Stipulations

The Calpine leases contain several special stipulations and conditions. Many of the restrictions are applicable to geothermal drilling and operations; however, some stipulations would be applicable to the proposed geophysical studies. These restrictions are summarized below

Proposed actions must not affect unique lava fields and geologic features, or surface occupancy of certain lands would not be permitted.

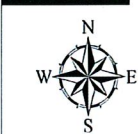


Figure 3.6-2: Visual Quality Objectives in the Project Area



SOURCE: USDA Forest Service, Pacific Southwest Region, Remote Sensing Lab 2006 and MHA Environmental Consulting 2008

**LEGEND**



- Proposed MT-TDE Station Location
- ▭ (Red Hatched) Maximum Modification Area
- ▭ (Orange Hatched) Preservation Area (Wilderness / Research / Natural Area)
- ▭ (Light Green) Partial Retention Area
- ▭ (Blue Hatched) Modification Area
- ▭ (Blue Outline) Calpine Lease Area Boundary
- ▭ (White) Retention Area





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- Proposed actions must not result in significant impacts on ongoing recreational use, or surface occupancy of certain lands would not be permitted.
- Proposed actions must not result in damage to antiquities or other objects of historic value, including but not limited to historic or prehistoric ruins, fossils, or artifacts discovered as a result of operation under the lease, and discoveries shall be left in tact.

## Land Use Plans

Applicable Management plans include:

- Klamath National Forest Land and Resource Management Plan
- Modoc National Forest Land and Resource Management Plan
- Shasta-Trinity National Forest Land and Resource Management Plan

The applicable elements of each plan are described in Table 3.7-1. The Northwest Forest Plan and Sierra Nevada Forest Plans do not contain guidance relevant to this project. The Medicine Lake Highlands Historic Properties Management Program (HPMP) specifically responds to stipulations of the Fourmile Hill Geothermal Development Project Memorandum of Agreement signed in 2000. The Forest Service and BLM developed the HPMP in consultation with Tribes, California State Historic Preservation Office and the Advisory Council on Historic Preservation (USFS 2007).

The HPMP is a program that guides the management of cultural, spiritual, and natural resources of the Medicine Lake area; but, it is not meant to be a decision document in terms of NEPA decisions, or to be a forest plan amendment. Related management guidance from the plan as relevant to the proposed action is included in Table 3.7-1. The HPMP is discussed in greater detail in Section 3.4 Cultural Resources.

**Table 3.7-1: Land Use Plan Management Goals Relevant to the Proposed Action**

Plan	Management Goals Applicable to the Proposed Action
Klamath National Forest Land and Resource Management Plan (USFS 2001a)	<ul style="list-style-type: none"> <li>• The submission of a notice of intent or plans of operation for all mineral-related activities where the potential for significant resource disturbance exists is required.</li> <li>• A reasonable means of access, consistent with management objectives for the area, should be approved when it is determined to be incidental to the operation.</li> <li>• In Retention and Partial Retention Management Areas, reasonable mitigation measures should be incorporated into approved plans of operation to meet the designated visual quality objectives (VQOs).</li> <li>• In Special Interest Areas, review plans of operation and require operations to rehabilitate ground-disturbing activities.</li> <li>• Approval of plans of operation or notices of intent shall incorporate steps to minimize detrimental effects to threatened, endangered, and sensitive species habitat.</li> <li>• Provide for Native American needs for collection and/or use of traditional resources.</li> </ul>



**Table 3.7-1 (Continued): Land Use Plan Management Goals Relevant to the Proposed Action**

Plan	Management Goals Applicable to the Proposed Action
Modoc National Forest Land and Resource Management Plan (USFS 2001b)	<ul style="list-style-type: none"> <li>• Provide new energy sources by allowing wind, geothermal, solar hydroelectric, and biomass development. Accommodate development of geothermal, gas, and oil resources.</li> <li>• Management activities should not alter the scenic and scientific values of Special Interest Areas.</li> <li>• Maintain the water quality of Medicine Lake, and evaluate the potential of each project in the watershed to degrade the water quality of Medicine Lake.</li> <li>• Inventory and protect active goshawk territories needed to meet population targets.</li> </ul>
Shasta-Trinity National Forest Land and Resource Management Plan (USFS 1995)	<ul style="list-style-type: none"> <li>• Mitigate adverse effects to heritage resources that are eligible for the National Register of Historic Places, according to direction issued by the Department of the Interior and the Advisory Council on Historic Preservation.</li> <li>• Analyze the potential effects of all ground-disturbing projects on sensitive and endemic plants and their habitat. Mitigate project effects to avoid a decline in species viability at the Forest level.</li> </ul>
The Medicine Lake Highlands Historic Properties Management Program (USFS 2007)	<ul style="list-style-type: none"> <li>• Mineral and energy exploration and development are covered by existing laws and regulations.</li> </ul>

**SOURCES:** As Listed

### 3.7.2 RECREATION

#### Overview of Recreation in the Medicine Lake Highlands

The role of Medicine Lake as a recreation destination point is changing from a regional perspective. The Medicine Lake Highlands have traditionally been visited by people familiar with the lake’s reputation for fishing and are within two hours driving distance, or by families who would stay for an extended vacation. Visitor use is now increasing and use patterns are changing (BLM 2002).

The scenic, geologic, biologic, and historic resources of the Medicine Lake Highlands, the Lava Beds National Monument (north of the project area), and Tule Lake National Wildlife Refuge (northeast of the project area) provide a series of diverse year-round recreation opportunities in relatively close proximity to one another. The reputation of the region as a relatively uncrowded tourist destination area is becoming more broadly known.

Visitors to Medicine Lake would typically stay and participate in recreation activities in the immediate area due to poor access and road conditions. With improvement of the road system over the years, visitors currently tend to camp at the lake and use it as a home base. Recreationalists now spend considerable time scenic driving, off-road touring, and mountain bicycling throughout the Medicine Lake Highlands and at adjacent use areas such as Lava Beds National Monument. Visitors to the National Monument are often referred to the Medicine Lake campgrounds as an alternative to the Monument’s own campground.

Native American use of the Medicine Lake Highlands is discussed in Section 3.4 Cultural Resources and Native American Concerns.

### Developed Recreational System around Medicine Lake

Developed recreation areas are all located within the boundaries of the USFS-designated Recreation Management Area (RMA), which is generally centered on Medicine Lake. Most of the developed recreation uses within the RMA are located on the shores of Medicine Lake. Most of the proposed survey locations would be within the RMA; however, some are located in dispersed recreation areas, and are discussed in the section below.

Typically developed recreational activities that occur in the vicinity of the proposed action include camping, fishing, picnicking, boating, swimming, and hiking. Snowmobiling and cross-country skiing also occur during the winter season; however, the proposed action would not occur during winter. As shown in Figure 3.7-1, a variety of facilities have been developed within the area, including:

- Four campgrounds along the lake's northern and northwest shoreline
- A day use area consisting of a boat launch, picnic facilities, and a swimming beach located along the lake's eastern shoreline
- Picnic facilities and trail staging at Little Medicine Lake
- Trails connecting the day use areas, campgrounds, Little Medicine Lake and the Medicine Lake Lava Flow
- An undeveloped, designated overflow camping area located at Schonchin Springs, just northwest of Medicine Lake

The four developed campgrounds in the vicinity, all of which are located on the northern and western shores of Medicine Lake, are:

- Medicine Lake Campground (22 camp sites)
- A.H. Hogue Campground (42 camp sites)
- Hemlock Campground (19 camp sites)
- Headquarters Campground (8 camp sites)

The operating season for the campgrounds is July through October. Although busy at certain times of the year (e.g., holiday weekends), these campgrounds are rarely full.

- Other developed recreational facilities at Medicine Lake include three recreation residences (under special use permit from the USFS) and about 44 summer use cabins located on private lands on the southeast side of the lake and one dwelling on the southwest (Siskiyou County 2002). These residences are generally accessible only during the summer months, but can be occasionally accessed in the winter when weather conditions allow.

### Dispersed Recreation Areas

Some survey locations would be outside of the RMA and are thus considered to be located in dispersed recreational areas. These areas have not been, and are not planned to be, developed for intensive recreation use. June through October is the primary months of dispersed recreation area use due to cold weather and snow during other times of the year.

Approximately 80 percent of the recreation activities available in the Klamath and Modoc National Forests relate to dispersed recreation uses and activities. Use levels on the Gooseneck Ranger District of the Klamath National Forest and Doublehead Ranger District of the Modoc National Forest are currently at just under 200,000 and over 300,000 visits per year respectively. As described below, dispersed recreation uses in the project vicinity vary between the summer months and the winter months (BLM et al. 2002).



Hunting and recreational driving for the purposes of sightseeing on the many primitive roads in the Modoc and Klamath National Forests are the primary recreational activities that occur in dispersed recreation areas in the summer. Deer hunting is the most popular type of hunting in the Medicine Lake area. The deer hunting season typically lasts about 2 weeks in October, though the length of time that deer hunting season is open varies from year to year (Figura pers. comm. 2008). Camping, nature study, hiking, bicycling, and off-road vehicle use are other typical dispersed recreational activities that occur in these areas during summer months. Although all forest roads are used in the area for dispersed recreation, popular routes of travel for sightseeing and accessing dispersed recreation uses include (BLM et al. 2002):

- Forest Route 49 between Medicine Lake and Lava Beds National Monument (north of the project study area)
- Forest Route 97
- Forest Roads 43N53 and 43N99 (Lyons Peak Loop Road) to access the Glass Mountain Lava Flow
- Forest Road 43N48 between Medicine Lake and Little Mount Hoffman Lookout

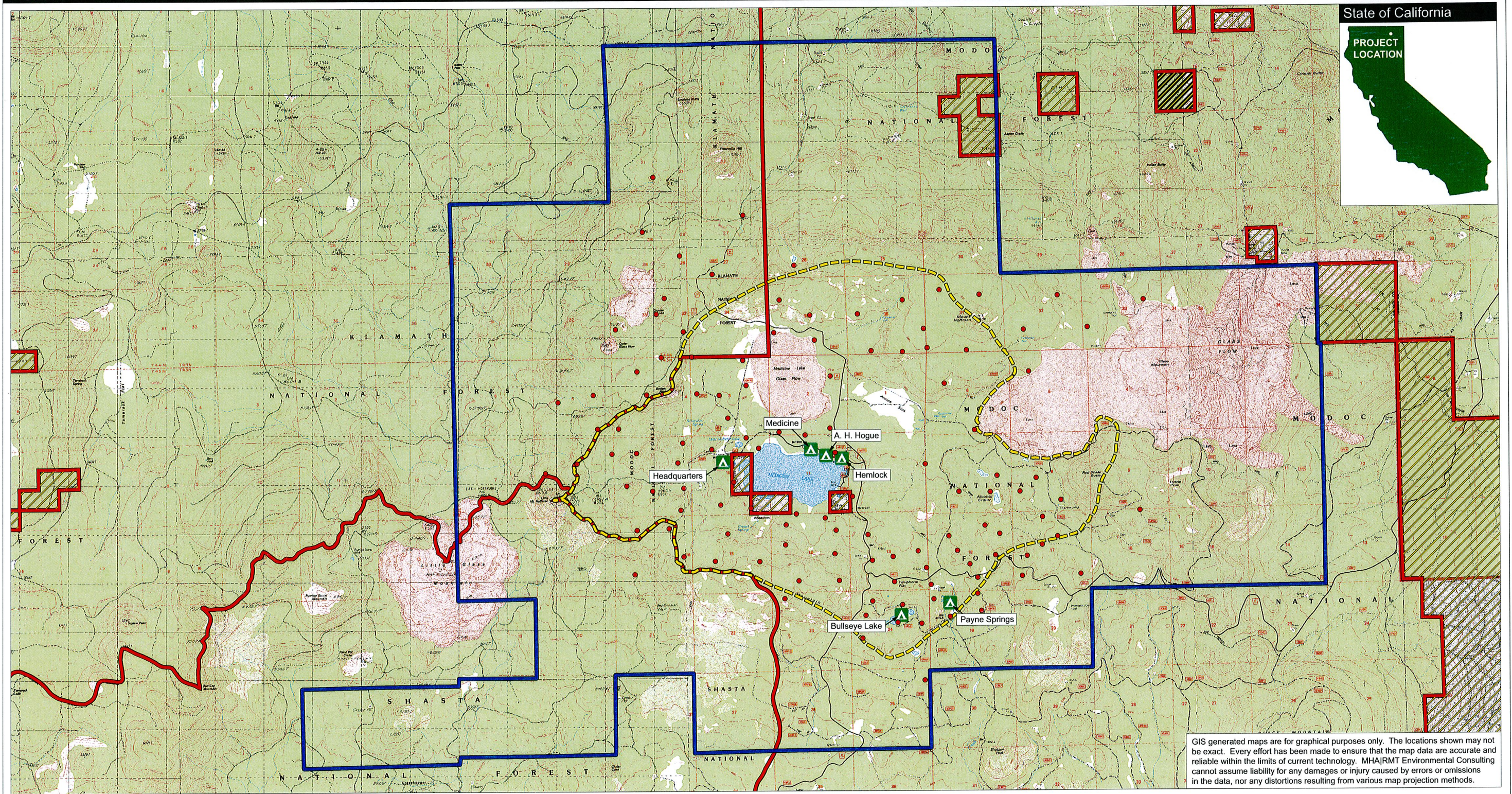
#### **Recreation Opportunity Spectrum**

The USFS manages its lands using the Recreation Opportunity Spectrum (ROS) classification system for recreational opportunities and experiences on the Forests. The ROS provides a framework for defining the types of outdoor recreation opportunities the public might desire and identifies that portion of the spectrum a given forest area might be able to provide. The ROS allocations provide overall guidance to manage specific projects or areas in a fashion that are compatible with the allocation assigned to the overall area. The allocations typically relate to allowances for or prohibitions on vehicle travel, degree of resource modifications, and intensity of recreation use. These allocations are defined below.

- **Roaded Natural:** A Roaded Natural area is characterized by a naturally appearing setting. Resource modification and utilization practices are evident, but harmonize with the natural environment with moderate evidences of the sights and sounds of humans. Interaction between users may be low to moderate, but with evidence of other users prevalent. Conventional motorized use is provided for in construction standards and design of facilities.
- **Semi-Primitive Motorized:** A Semi-Primitive Motorized area is characterized by a predominantly natural or natural-appearing environment of moderate to large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is permitted. Wildlife species present are mid-range between those tolerant of human presence and those not.
- **Semi-Primitive Non-Motorized:** A Semi-Primitive Nonmotorized area is characterized by a predominantly natural or natural-appearing environment of moderate to large size. Interaction among users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but are subtle. Motorized use is not permitted. Large mammals which are not too tolerant of humans may be present.
- **Primitive:** A Primitive area is characterized by an essentially unmodified natural environment of a fairly large size. Interaction between users is very low and evidence of other users is minimal. The area is managed to be essentially free from evidence of human-induced restrictions and controls. Motorized use within the area is not permitted.



Figure 3.7-1: Recreational Facilities and Land Uses in the Project Area



GIS generated maps are for graphical purposes only. The locations shown may not be exact. Every effort has been made to ensure that the map data are accurate and reliable within the limits of current technology. MHA/RMT Environmental Consulting cannot assume liability for any damages or injury caused by errors or omissions in the data, nor any distortions resulting from various map projection methods.

SOURCE: U.S. Geological Survey, EROS Data Center, Sioux Falls, SD and RMT 2008

**LEGEND**

	Proposed MT / TDEM Station (not to scale)		Recreation Management Area Boundary		Private Property Parcel Area		Campground
	Calpine Federal Lease Boundary		National Forest Area Boundary				

0 0.5 1 2 3 4 Miles





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Most areas in the vicinity of the proposed project have a ROS allocation of “Roaded Natural”. Three areas in the project vicinity have other ROS allocations. The ROS allocation for the western portion of the Mount Hoffman roadless release area is “Semi-Primitive Non-Motorized”, and the Medicine Lake and Glass Mountain Lava Flows are both allocated as “Primitive.”

## 3.8 Transportation and Traffic

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### 3.8.1 OVERVIEW

The study area for the transportation analysis of the proposed project includes the road system servicing the project area within approximately ten miles of the project area. The analysis focuses on roads that would be used by project personnel during the project, including roads in the general vicinity of the proposed survey sites. Some roads are located on the Klamath, Shasta-Trinity, and Modoc National Forests. Other major arterials that extend beyond these National Forests are also discussed. The State Department of Transportation (Caltrans) is the primary State agency responsible for improving and maintaining roads for the State of California. The State has responsibility to administer and maintain State Routes, while the local county is responsible for local roads. Local jurisdictions work with Caltrans to designate transportation network requirements and critical areas in need of improvement.

### 3.8.2 HIGHWAYS

#### Highway Infrastructure

Regional access to the area is provided by a highway system that encircles the Medicine Lake Highlands and includes Interstate 5 (I-5), State Highway 89, State Highway 139, and U.S. Highway 97. There are no officially designated State or County Scenic Highways in Siskiyou County (Caltrans 2007b). A portion of Interstate 5 is eligible to be designated as a State Scenic Highway (Caltrans 2008). Portions of Highway 89, Highway 97, Highway 139, and I-5 are part of the Volcanic Legacy Scenic Byway (Byways.org 2008). Figure 3.8-1 Shows highway access to the project region.

#### Traffic Volume and Level of Service

Level of service (LOS) is a scale of values with designations “A” through “F,” that describes degree of street congestion, or interference with the normal free flow of traffic. LOS “A” indicates free traffic flow at design speed or the absence of congestion, while LOS “F” indicates congested conditions where traffic flow is seriously restricted and travel speeds are significantly below design speed. The Siskiyou County General Plan Circulation Element provides for a normal level of service of at least Level C (Siskiyou County 1988). Caltrans policy is to maintain LOS at C or D on Caltrans-maintained roads (Siskiyou County 2006). The LOS of each highway is listed in Table 3.8-2. State Route 139 is not listed because the last traffic study was undertaken in the early 1980s (White pers. comm. 2008).



**Figure 3.8-1: Highway Access to the Project Location**



SOURCE: BLM, Alturas Resource Area Office 2003 and RMT 2008

**LEGEND**

		U.S. Highway	California State Route
		Interstate Highway	Oregon State Route

**Table 3.8-2: Levels of Service for Regional Access Routes to of the Project Area**

Road	Level of Service
<b>Interstate 5 (2005)</b>	
Dunsmuir Avenue to Jct SR 89-Northbound	B
South Weed Interchange to Central Weed Interchange/Jct. US 97	A
<b>State Route 89 (2000)</b>	
Mountain House Road to Jct. SR 5 Northbound	C
Mountain House Road to Jct. SR 5 Southbound	C
<b>U.S. Highway 97 (2002)</b>	
Beginning Passing Lane to Tenant Bray Road Northbound	C
Beginning Passing Lane to Tenant Bray Road Southbound	D

SOURCE: Caltrans 2007c

### 3.8.3 LOCAL ROADS

#### Road Infrastructure

##### National Forest Roads

The project area is located entirely on National Forest lands, and roads in the project area are managed by the USFS. National Forest roads provide access for a variety of activities, such as timber harvest, recreation, fire protection and suppression, and forest management activities.

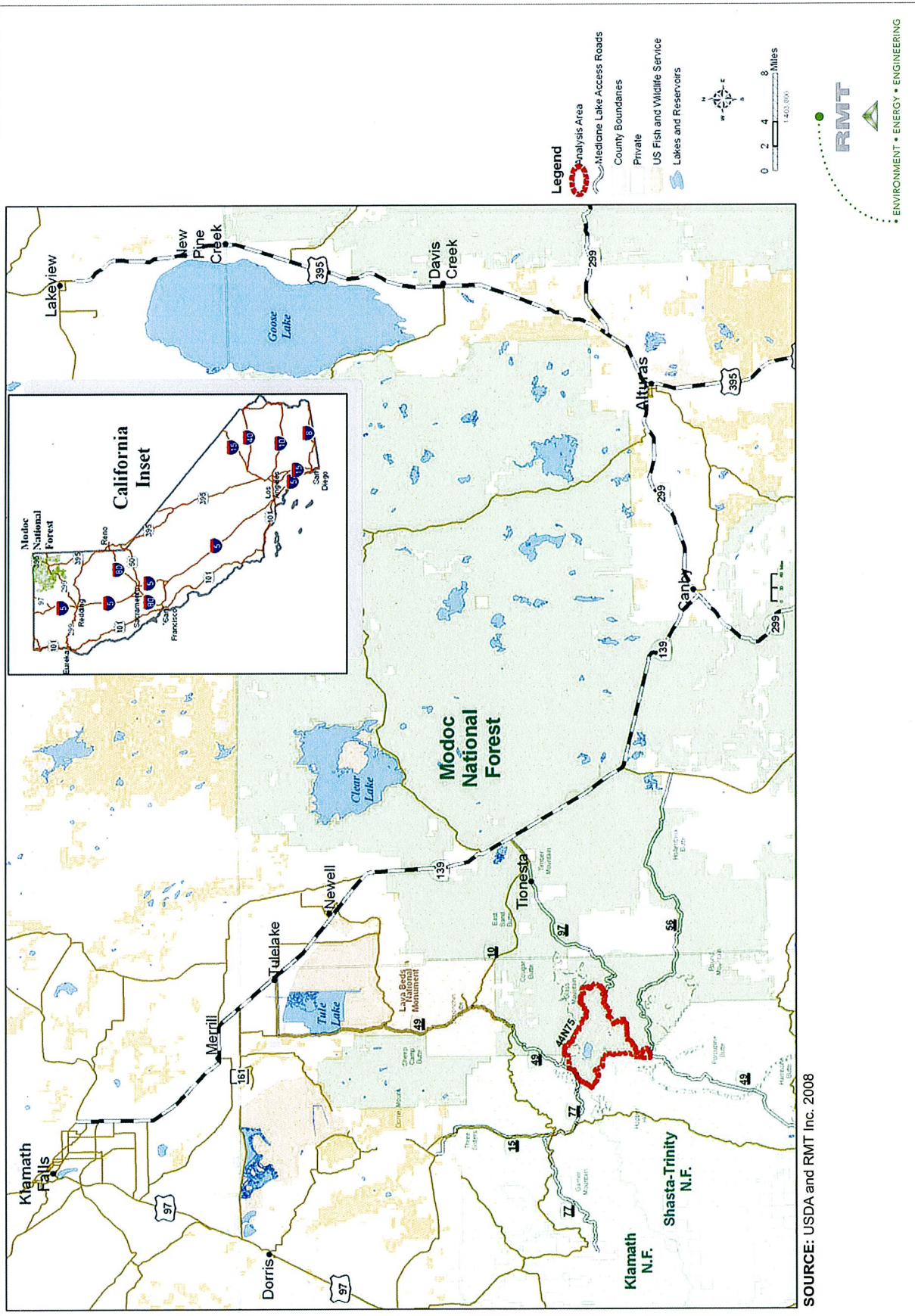
The Forest Service roads in the project area can be accessed by several existing paved and gravel-surfaced arterial roads, as well as many gravel-surfaced collector roads. The primary access routes in the project vicinity are illustrated in Figure 3.8-2 and summarized below.

- **Medicine Lake Highway (Forest Route 97).** Forest Route 97 is a paved two-lane arterial that extends west from Highway 139 near Tionesta to Medicine Lake.
- **Forest Route 49.** Forest Route 49 is a partially paved, partially gravel-surfaced, primarily single-lane arterial with turn-outs. It extends south from Lava Beds National Monument past Medicine Lake to Highway 89.
- **Davis Road (Forest Route 15).** Forest Route 15 is a paved, two-lane arterial that extends southeast from Macdoel (at Highway 97) to the vicinity of Medicine Lake, and then heads southwest from the Medicine Lake area to Highway 89. In general, summer traffic volumes tend to be higher than during the winter.
- **Forest Route 77 (45N50).** Forest Route 77 is a partially paved, partially gravel-surfaced, two-lane arterial that extends east from Highway 97 past Forest Route 15 to the vicinity of Medicine Lake.
- **Other National Forest Roadways.** In the immediate vicinity of Medicine Lake, the USFS has paved some roads (such as Forest Road 43N48, which runs along the northern shore of Medicine Lake) in order to better accommodate recreational traffic. However, these roads have received only a thin surface pavement, and are not designed to handle heavy loads such as logging or water trucks (BLM 2002)

There are several gravel-surfaced roads that traverse the vicinity of the project area, as well as many unimproved dirt access and spur roads. These roads have been established primarily to support timber harvest activities and to provide access to more remote parts of the Modoc Forest. USFS personnel frequently use these roads, as do hunters, campers, and other recreationalists. Geothermal exploration companies have also used these roads to access existing geothermal well



Figure 3.8-2: Highway and Primary Forest Route Network in the Vicinity of the Project



SOURCE: USDA and RMT Inc. 2008

pads. Travel on area roads occurs primarily during the summer months since this is the period of highest Forest use (BLM 2002).

The USFS adopted a new road management policy in January 2001, which directs the agency to maintain a safe, environmentally sound road network that is responsive to public needs and affordable to manage. The policy includes a scientific road analysis process designed to help managers make better road-related decisions (USFS 2002). The Klamath, Shasta-Trinity, and Modoc Land and Resource Management Plans contain forest wide and focused standards according to each resource area. Every proposed project must comply with USFS direction from the resource management plans.

### **Roads in Medicine Lake Highlands**

The USFS issued a Draft EA for road closures in the Medicine Lake Highlands in January 2008 in order to restrict Forest visitor vehicle travel to designated roads, providing greater protection to the natural resources, recreational use, and archaeological values of the area. The Doublehead Ranger District issued a Finding of No Significant Impact and a decision to approve the road closures in March 2008. The decision resulted in the closing of 27.8 miles of existing National Forest System roads and 6.64 miles of known unauthorized user created routes. A complete list of open and closed roads in Medicine Lake Highlands can be found in Appendix I. The closed roads will not be decommissioned, and could be used for fire suppression and administrative duties (USFS 2008a); however, these roads can not be used by recreationalists. Calpine can use these roads with special authorization from the USFS. Figure 3.8-3 shows the remaining open roads in the Medicine Lake Highlands.

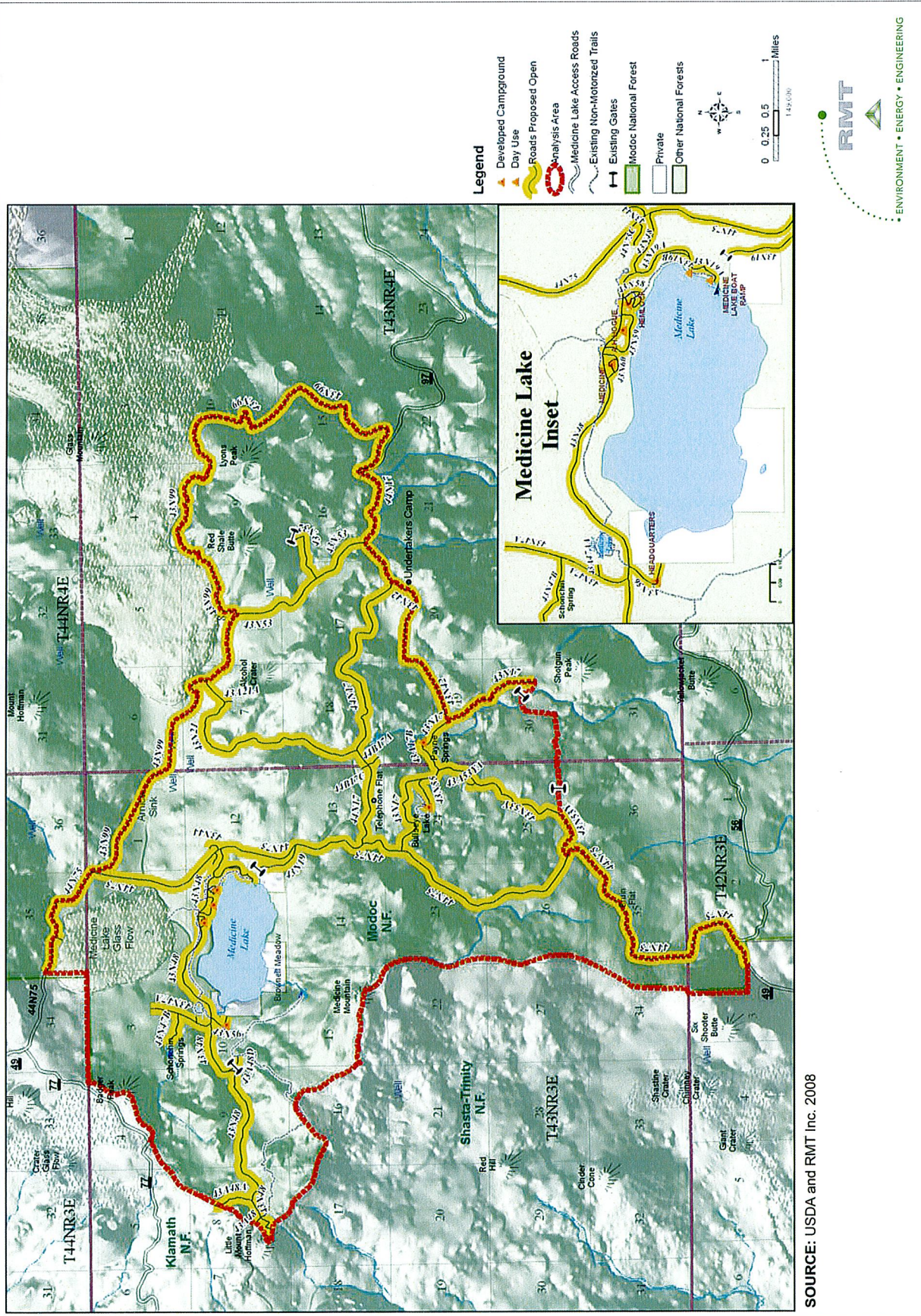
The Medicine Lake Highlands area also falls under Zone C on the Off-Highway Vehicle Use Map which accompanied the Modoc National Forest LRMP. Motorized land vehicle travel is prohibited off of existing roads and trails and permitted on existing roads and trails except for those designated closed in Zone C. The Medicine Lake Glass Flow area is within the project area and is classified as a Geologic Special Interest Area where motorized travel is prohibited (USFS 2008b).

### **Traffic Volumes**

Traffic volumes in the vicinity are very low and are typical of rural areas with sparse populations. Travel on these roads occurs primarily during the summer months because of increased recreation and other forest uses. National Forest roads are generally closed during the winter months because of snow cover.



Figure 3.8-3: Roads in the Medicine Lake Highlands that are Open to the Public





## 3.9 Air Quality

### 3.9.1 CLIMATE

The major topographic feature of the project vicinity is the Medicine Lake Highlands. The Cascade Range contains a north-south chain of isolated volcanic peaks. Considerable climatic variations occur in the region as a result of this topography (BLM et al. 1998).

Weather in northern California is dominated by the position of the Eastern Pacific high-pressure cell normally located off the coast of North America (BLM et. al 1998). Due to the positioning of this cell, an almost unbroken chain of winter storms occurs at the proposed project area, and a bulk of the precipitation within the proposed project area occurs during this winter storm period. Weather systems in the region usually result in strong winds and unstable air masses, providing for good dispersion conditions. During fair weather periods, stable air conditions prevail throughout the region.

Data was collected at the Indian Well Headquarters Weather Station at Lava Beds National Monument over a 56-year period (December 1945 through September 2001). The average annual precipitation in the vicinity of the proposed project area is approximately 15.3 inches of rainfall and 44.1 inches of snowfall per year. Highest rates of snowfall occur in January; there is no snow from July to September. The highest rates of precipitation occur in December, while the driest month is August. Recorded temperatures in the project vicinity have ranged from -18°F in the winter to 102°F in the summer. The highest average temperature of 82.2°F occurs in August, while the lowest average temperature of 40.3°F occurs in January (NPS 2001).

### 3.9.2 AIR QUALITY

#### Air Basin

The proposed project would be located in Siskiyou County within the Northeast Plateau Air Basin (NPAB). The NPAB extends from the Nevada border on the east to the Siskiyou Mountains on the west; from the Oregon border in the north to the southern border of Lassen County; and includes all of Lassen, Siskiyou, and Modoc Counties. The NPAB encompasses a total area of 14,920 square miles (BLM et al. 1998).

#### Air Quality Regulations

##### Federal

The Clean Air Act requires the EPA to identify ambient air quality standards AAQS to protect public health and welfare. Pursuant to the Clean Air Act, the EPA has classified air basins (i.e., distinct geographic regions) as either “attainment” or “non-attainment” for each criteria pollutant, based on whether or not the federal ambient air quality standards have been achieved. National air quality standards are set at levels determined to be protective of public health with an adequate safety margin. Some air basins have not received sufficient analysis for certain criteria air pollutants and are designated as “unclassified” for those pollutants.

Siskiyou County is classified as “attainment<sup>4</sup>” or “unclassified<sup>5</sup>” according to national standards for all pollutants. At the federal level, the NPAB is designated as “unclassified/attainment” for ozone (O<sub>3</sub>), particulate matter fewer than 2.5 microns in diameter (PM<sub>2.5</sub>), and CO. It is designated

<sup>4</sup> Air quality does not violate national standards.

<sup>5</sup> Insufficient data to determine attainment or nonattainment.



3: AFFECTED ENVIRONMENT

“attainment” for nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), and lead. It is designated “unclassified” for particulate matter fewer than 10 microns in diameter (PM<sub>10</sub>). Air quality designations and regulations are listed in Table 3.9-1 (CARB 2008).

Ambient standards are listed in Table 3.9-1 for criteria pollutants that the proposed project could potentially emit. The standards are expressed in terms of different averaging times; for example, annual, 24-hour, etc. Table 3.9-2 lists the federal emissions standards that apply to direct sources.

A Class 1 airshed requires the highest level of protection under the Clean Air Act. The Lava Beds National Monument is the closest Class 1 airshed to the project area. Lava Beds National Monument is approximately 8 miles northeast of the project area.

**Table 3.9-1: National Clean Air Act Air Quality Designations in Siskiyou County (2008)**

Pollutant	Standard (Primary <sup>6</sup> Annual Arithmetic Mean)	Classification (National)
Ozone	0.08 ppm (8-hour)	Unclassified/Attainment
Particulate Matter (PM <sub>10</sub> )	150 µg/m <sup>3</sup> (24-hour)	Unclassified
Particulate Matter (PM <sub>2.5</sub> )	15 µg/m <sup>3</sup>	Unclassified/Attainment
Carbon Monoxide (CO)	9 ppm (8-hour)	Unclassified/Attainment
Nitrogen Dioxide (NO <sub>2</sub> )	0.053 ppm	Attainment
Sulfur Dioxide (SO <sub>2</sub> )	0.030 ppm	Attainment
Lead	1.5 µg/m <sup>3</sup> (Calendar Quarter)	Attainment

**SOURCE:** CARB 2008, CARB 2006

**Table 3.9-2: Significant Emission Rates for Pollutants Regulated Under the Clean Air Act**

Significant Pollutant	Emission Rate
Carbon Monoxide	100 tons/year
Nitrogen Oxides	40 tons/year
Particulate Matter	25 tons/year
PM <sub>10</sub>	15 tons/year
Sulfur Dioxide	40 tons/year
Volatile Organic Compounds	40 tons/year
Lead	0.6 ton/year
Fluorides	3 tons/year
Sulfuric Acid Mist	7 tons/year
Hydrogen Sulfide	10 tons/year
Total Reduced Sulfide	10 tons/year

**SOURCE:** DEQ 2001

<sup>6</sup> Level of air quality necessary to protect public health with a sufficient margin of safety.

A federal conformity analysis is required for any federal action within any federal non-attainment or maintenance area. The project area does not fall within an area that meets these criteria (Dunn pers. comm. 2008).

### State

The California Air Resources Board (CARB) is the State agency responsible for regulating mobile source (vehicle) emissions and overseeing the activities of local air pollution control districts. CARB established state ambient air quality standards for all federally-regulated pollutants in addition to sulfates, hydrogen sulfide, vinyl chloride and visibility-reducing particles. The state standards are generally more stringent than the federal standards. Under the California Clean Air Act, areas have been designated as attainment, non-attainment, or unclassified with respect to state ambient air quality standards. At the state level, Siskiyou County has been designated as attainment for NO<sub>2</sub>, SO<sub>2</sub>, lead, PM<sub>10</sub>, as non-attainment/transitional for ozone (O<sub>3</sub>), and as “unclassified” for PM<sub>2.5</sub>, and CO (CARB 2008).

State standards and attainment statuses are listed in Table 3.9-3.

Pollutant	Standard (Concentration)	Classification
Ozone	0.070 ppm (8-hour)	Nonattainment/Transitional
Particulate Matter (PM <sub>10</sub> )	20 µg/m <sup>3</sup> (Annual Arithmetic Mean)	Attainment
Particulate Matter (PM <sub>2.5</sub> )	12 µg/m <sup>3</sup> (Annual Arithmetic Mean)	Unclassified
Carbon Monoxide (CO)	9.0 ppm (8-hour)	Unclassified
Nitrogen Dioxide (NO <sub>2</sub> )	0.030 ppm (Annual Arithmetic Mean)	Attainment
Sulfur Dioxide (SO <sub>2</sub> )	0.04 ppm (24-hour)	Attainment
Lead	1.5 µg/m <sup>3</sup> (30-Day Average)	Attainment

SOURCE: CARB 2008, CARB 2006

### Air Quality in Siskiyou County

Sources of PM<sub>10</sub> in the Siskiyou County area are both natural and manmade. Natural sources such as wind-blown dust, pollen, and intermittent forest fires can occasionally contribute to increased local levels of pollutants in the atmosphere. Forest fires emit air pollutants such as nitrogen oxides, particulates, and unburned organic compounds. Together with natural sources, human activities in rural areas such as dirt road travel and infrequent forest slash and burning can also contribute to occasional locally elevated air pollution levels.

The primary source of PM<sub>10</sub> and the related pollutant, total suspended particulates (TSP), in Siskiyou County is fugitive dust. The sources of PM<sub>10</sub> are principally vehicular traffic on unpaved roads and wind erosion of cultivated agricultural land. PM<sub>10</sub> can also be created indirectly in the atmosphere from chemical reactions that convert gaseous precursors into small particles. These PM<sub>10</sub> precursors, which are predominantly products of man-made combustion, include nitrogen oxides, reactive organic gases, and sulfur oxides.

Principal existing PM<sub>10</sub>/TSP sources in the vicinity of the proposed project area are wind erosion from disturbed areas, and vehicular traffic on unpaved roads.



## Greenhouse Gases

Greenhouse gases (GHGs) are global pollutants, unlike criteria air pollutants and toxic air contaminants. The most prominent GHGs that have been identified as contributing to global warming include:

- Carbon dioxide (CO<sub>2</sub>)
- Methane (CH<sub>4</sub>)
- Nitrous oxide (N<sub>2</sub>O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulfur hexafluoride (SF<sub>6</sub>)

Emissions of GHGs contributing to global climate change are attributable largely to human activities associated with the industrial/ manufacturing, utility, residential, and agricultural sectors. Transportation is also a large contributor of GHGs, particularly CO<sub>2</sub>. The proposed project has the potential to emit greenhouse gases from use of vehicles to access survey locations.

## 3.10 Noise

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### 3.10.1 TECHNICAL BACKGROUND

Noise is defined as unwanted or objectionable sound, and usually reflects changes from typical background noise levels and spectra. Airborne sound is described as a rapid fluctuation of air pressure above and below the atmospheric pressure. Magnitude, frequency and duration are the variables used to characterize noise. In general, people can perceive a 3 dB difference in noise levels, and a difference of 6-10 dB is perceived as a doubling of loudness. Distance serves to attenuate noise levels and changes frequencies. With every doubling of distance, there is a corresponding reduction in noise levels of approximately 5 to 6 dB. Noise levels from familiar sources are shown in Table 3.10-1.

### 3.10.2 NOISE LEVELS

#### Overview

Ambient noise levels in the vicinity of the proposed action are low and typical of rural and open space areas. Natural noise sources include animals, wind, and occasional summer thunderstorms.

No major manmade sources of constant noise (such as industrial facilities) currently exist in the vicinity of the proposed action. The most significant existing sources of noise are machinery and vehicles. The use of machinery for logging and mining operations results in occasional audible noise in portions of the vicinity of the proposed action. Noise from the use of recreational vehicles (such as motorcycles or snowmobiles) in the area is also occasionally audible.

#### Medicine Lake Area

Noise levels in the proposed action area are relatively low and are representative of undeveloped areas. The majority of the project area is remote. Ambient noise levels range from 20 to 30 dBA when people are absent, which is typical for a wilderness area. Table 3.10-2 identifies ambient noise levels at sensitive noise receptors around Medicine Lake. The table only presents a few locations; however, ambient noise levels at these sites are representative of conditions at other locations. The background sound level (or  $L_{eq}$ ) is highest at the campground north of Medicine Lake because it had the most people present.

**Table 3.10-1: Typical Residential/Commercial Noise Sources and Levels**

Noise Source	Noise Level (dBA)
Rustle of leaves in breeze	25
Whisper (at 6 feet)	35
Inside average residence	40
Refrigerator (in same room)	40
Average office	55
Normal female speech (at 3 feet)	60
Vacuum cleaner (at 10 feet)	70
Garbage disposal (at 3 feet)	80
Food blender (at 3 feet)	90
Auto horn (at 10 feet)	100

**SOURCE:** J.J. Van Houten 1974

The  $L_{90}$  and  $L_{99}$  noise levels are also good indicators of background noise levels because they are less affected by temporary high noise events (e.g., automobile and motorboat pass-bys, and aircraft fly-overs) than other statistical measurements of noise. The Little Medicine Lake area, about 1,000 feet northwest of Medicine Lake, is much quieter (by about 6 dBA) than the other two locations, as shown in Table 3.10-2.

Other factors besides heightened campground occupancy may intermittently cause increased noise levels. Snowmobile use during the winter and rifle noise during the hunting season could result in intermittently elevated noise levels in the project area.

### **Bullseye and Blanche Lake Areas**

Bullseye and Blanche Lakes are located nearly two miles southeast of Medicine Lake (see Figure 3.3-1). As with the Medicine Lake area, sensitive receptors in these areas would include visitors and seasonal residents. Ambient noise levels in these areas are slightly less than those around Medicine Lake.

### **3.10.3 NOISE STANDARDS AND POLICIES**

The Noise Element of the Siskiyou County General Plan (Siskiyou County 1978) does not specifically regulate geothermal noise, and the General Plan jurisdiction does not extend to the Federal land on the National Forests. There are no Federal noise standards or Forest Land Use and Management Plan guidelines that are used by the Klamath, Shasta-Trinity, or Modoc National Forests in addressing and evaluating noise.

### **3.10.4 SENSITIVE RECEPTORS**

Sensitive receptors in the area include recreationists, Native Americans, and residents. Recreational opportunities are widely dispersed; however, recreational opportunities tend to be concentrated around Medicine Lake and other bodies of water (e.g., Blanche Lake). Native American populations use the area for spiritual and traditional reasons, and many sacred sites are located near Medicine Lake. There are also clusters of homes, mainly on the southeast side of Medicine Lake, that are used as vacation homes (cabins), who would be sensitive to noise generation.



**Table 3.10-2: Ambient Noise Levels at Medicine Lake<sup>1</sup>**

Noise Levels in dBA							
Site	L <sub>eq</sub> <sup>2</sup>	L <sub>01</sub>	L <sub>10</sub>	L <sub>50</sub>	L <sub>90</sub>	L <sub>99</sub>	Noise Levels Representative of Conditions Elsewhere <sup>3</sup>
North Campground ≈50 ft from road (Campsite 31)	37.0 <sup>2</sup>	41.9	38.9	36.8	30.3	28.1	Campgrounds on north side of Medicine Lake
Southeast corner of Medicine Lake, south of boat ramp	35.8	44.7	38.8	33.4	30.7	29.7	Group of homes southeast of Medicine Lake
Homes and Picnic area near Little Medicine Lake	33.0	42.9	37.0	28.2	24.7	23.10	Schonchin Picnic Area (Site 4), north of Little Medicine Lake; home on southwest end of Medicine Lake (Site 5)

**Notes:**

<sup>1</sup>The values shown are averages over recording periods conducted in September 1996.

<sup>2</sup> L<sub>eq</sub> is the average hourly equivalent sound level over a 24-hour period with a +10 dB weighting applied to the nighttime, which is what L<sub>dn</sub> is based on. L<sub>eq</sub>, or equivalent sound level, is the loudness of a constant sound having the same sound energy as the actual sound which varies in loudness over a given time period. L<sub>01</sub>, L<sub>10</sub>, etc. is the noise level exceeded 1, 10, etc. percent of the time over a specified time period. L<sub>01</sub> can be considered the maximum, or loudest, noise level while L<sub>99</sub> is the lowest, or most quiet.

<sup>3</sup>The ambient noise measurements taken at receptor locations 1 through 3 are also representative of ambient noise levels at the other locations identified in this column. The Schonchin Picnic Area and the home on the southwest corner of Medicine Lake would have similar ambient noise levels to those measured at Little Medicine Lake.

**SOURCE:** Consultants in Engineering Acoustics 1996

The federal Geothermal Resources Operational (GRO) Order Number 4 defines limits for noise from geothermal-related activities. Noise levels must be 65 dBA or less at the lease boundary or 0.5 miles from the source, whichever is greater.

### 3.11 Human Health and Safety/Hazards

#### 3.11.1 OVERVIEW

The project area can be characterized as rural and undeveloped within the Klamath, Shasta-Trinity and Modoc National Forests. The proposed surveys would be located in areas where commercial timber operations have been conducted. Recreation activities are also popular in the vicinity of the proposed surveys. There are also some residential uses in the area. There are approximately 35 summer cabins in the proposed project area (BLM et al. 1998). The homes are located on private lands on the southwest side of Medicine Lake (as shown in Figure 3.7-1).

#### 3.11.2 HAZARDOUS MATERIALS

The proposed project is located within a portion of the Klamath, Shasta-Trinity, and Modoc National Forests where minimal industrial uses have occurred. Existing land uses are primarily recreational, geothermal exploration, or timber harvesting, which require or produce only minimal hazardous materials (e.g., transport of gasoline, diesel, propane, and other fuels, etc.). No known hazardous material sites exist within the proposed project area (DTSC 2008).

Several rock and pumice queries are located in the project area. The rock quarries contain basaltic cinder used by the USFS. Isolated pumice quarries are currently inactive; however, a quarry located on the north flank of Glass Mountain, just outside of the Calpine lease area, is operational (BLM 2002). The only known hazardous materials used for these mining activities are oil, fuel, and lubricants. Timber operations would use similar hazardous materials; however, there are no active timber operations in the project area.

### 3.11.3 FIRE

#### Overview

Fires are naturally occurring phenomena in forested areas, and serve to shape and reshape the vegetative patterns and structures of these areas. Fire facilitates forest regeneration and succession, controls forest density, and removes dead and downed woody material (BLM 2002). Wildfires will occur more frequently when droughts occur and dead woody material accumulates on the forest floor. The fire season is considered to last from late May through mid-October, when there are periods of high temperatures and little to no moisture in the air. Fire history, current management practices, and fire detection and suppression on the Klamath, Shasta-Trinity, and Modoc National Forests are discussed below.

#### Fire History

Most recorded wildfires in recent history have been started by lightning strikes on the Klamath and Modoc National Forests, which is an uncontrollable and unpredictable source of ignition. About 75% of the fires on both Forests have been started by lightning during the periods for which fire records are currently available (1950 through 1990 on the Klamath, and 1910 to 1980 on the Modoc). People have started the remaining 25% of fires (BLM 2002). Lightning is also a common impetus for fires in the Shasta-Trinity National Forest, where half of annual fires are naturally-caused (USFS 2008). Campfire debris, discarded cigarettes, and slash burning fires are common causes, and continue to be a persistent problem on the Forests (BLM 2002).

The number of wildfires per year and acreage of burn per wildfire varies widely based on climate, fuel, and the ability of fire fighters to contain a given wildfire. The annual number of wildfires has ranged from about 90 to 340 fires per year on the Klamath National Forest, with an average of about 170 forest fires per year. The acreage burned per year by these fires has ranged from less than one acre to over 275,000 acres, with an average of about 12,000 acres burned by wildfires per year. The number of wildfires per year and the acreage of burn per wildfire on the Modoc and Shasta-Trinity National Forest have typically been consistent with the occurrences on the Klamath, though lightning strikes account for a smaller percentage of fires in the Shasta-Trinity National Forest than either the Klamath or Modoc National Forests (BLM 2002, USFS 1995).

#### USFS Fire Prevention and Management

The USFS enforces policies to prevent wildfires to the greatest extent possible and practice controlled, limited-scale burns in order to prevent more serious fires from occurring. The USFS also provides rapid-fire suppression response for large-scale wildfires, particularly those that pose a threat to humans and inhabited areas (BLM 2002).

*Current Management Practices.* On the Klamath, Shasta-Trinity, and Modoc National Forests, several methods are used to prevent and suppress forest fires. Fire prevention activities include public outreach and education efforts, forest patrols, and controlled underburnings. In recent years, forest management practices have been modified with the acknowledgment that occasional forest fires are necessary for a properly functioning forest ecosystem. Controlled burns serve to clear out the build-up of downed woody materials and help prevent larger conflagrations from occurring.



Selective thinning and other techniques also are used to develop healthier forest stands, which are generally more fire resilient (BLM 2002).

*Fire Detection and Suppression.* Strategic vantage lookout points within the Forests allow for early identification of wildfires. After lightning storms in the area, USFS personnel conduct reconnaissance flights over the Forests to assist in wildfire identification. The USFS also maintains a cooperative agreement with the California Department of Forestry (CDF). This agreement allows the CDF to assist the USFS in fire suppression efforts on the Forests, and the USFS to assist the CDF in fire suppression efforts in surrounding forested areas. The USFS has similar agreements with the BLM and Lava Beds National Monument for fighting fires in the region (BLM 2002).

A combination of fire breaks, water, and fire retardants are usually used to suppress wildfires depending on the nature of the wildfire and its severity. The Forests maintain wildfire suppression equipment, including fire engines, helicopters, and retardant aircraft. They also have staff that can serve as hand crews for creating firebreaks and conducting wildfire suppression activities.

#### **3.11.4 LEASE REQUIREMENTS**

The Geothermal Resource Operation Order No.4 General Environmental Protection Requirements include: "Protection of the environment includes the lessee's responsibility to...take all necessary precautions to protect the public health and safety..."

Relevant requirements of the leases include:

1. Provide warning signs, fencing, flagmen, barricades, or other safety measures deemed necessary to protect the public from any hazardous geothermal or related activities;
2. Comply with all applicable Federal and State standards with respect to disposal of liquid, solid, and gaseous wastes; and
3. Provide safeguards to minimize potential accidental fires, instruct field personnel in fire-prevention methods, and maintain firefighting equipment in working order in strategic locations.

## **3.12 Socioeconomics, Public Services, and Environmental Justice**

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### **3.12.1 SOCIOECONOMICS**

#### **Population**

The project area is located within Siskiyou County (County). Because of the small scale of the project, and the limited number of employees required to complete it, the study area has been limited to Siskiyou County. As of July 1, 2007, the population of Siskiyou County is estimated at 44,296 (US Census 2007). The County is predominantly rural, with the exception of the City of Yreka and the immediate area around it. The City of Yreka had a population of 7,348 in the 2007 (US Census 2007).

The majority of the population of Siskiyou County reports as White. The next largest racial group is American Indian/Alaska Native. Detailed estimates are provided in Table 3.12-1. California and US data are provided for comparison.

**Table 3.12-1: Race Statistics for Siskiyou County, California (2007)**

Race	Siskiyou County	California	United States
White alone	89.7%	76.8%	80.0%
Black or African American alone	1.4%	6.7%	12.8%
American Indian and Alaska Native alone	4.3%	1.2%	1.0%
Asian alone	1.4%	12.4%	4.4%
Native Hawaiian and Other Pacific Islander alone	0.2%	0.4%	0.2%
Two or more races	3.1%	2.5%	1.6%

**SOURCE:** US Census 2007

## Housing

Population in Siskiyou County is very sparse. There were an estimated 23,533 housing units in Siskiyou County as of July 1, 2007 (US Census 2007). The vast majority of housing in the unincorporated area of Siskiyou County are single-family dwellings.

Mobile homes have gained immensely in popularity, since they have remained affordable. The County also allows mobile homes on foundations in zoning districts where single-family dwellings are allowed.

There are about 45 dwellings in the vicinity of the proposed project (Siskiyou County Assessor's Office 2002). Most dwellings are located on the southeast side of Medicine Lake. These dwellings are mostly used as recreational or second homes (cabins) and are not occupied year-round (BLM 2002).

### 3.12.2 PUBLIC SERVICES

#### Schools

Siskiyou County has 28 public school districts (SCOE 2008). Other educational facilities include the College of the Siskiyous, Shasta College, and Simpson College.

Libraries are located throughout the County. The largest libraries, the Siskiyou County Library and the College of the Siskiyous Library, are located in Yreka and Weed, respectively. A remote educational computer center is located in Happy Camp and other sites are currently being developed.

There are no schools or libraries within the project area.

#### Emergency Services

The nearest hospital to the proposed project area is Mercy Medical Center in Mt. Shasta, California, which is about 50 miles driving distance from the project area. There is also ambulance service available in Mt. Shasta, California.

#### Fire Protection

Fire protection in Siskiyou County is provided primarily by volunteer fire departments that are in most communities throughout the County. Siskiyou County has established 12 fire protection districts with varying capacities, equipment, manpower, and relative response times.



Because the proposed project area is on USFS property, fire protection duties in the project area belong to the USFS. The USFS program focuses primarily on wildland fires, but also has a limited capacity to fight structural fires.

The USFS provides fire-fighting services in the Klamath, Shasta-Trinity, and Modoc National Forests. The USFS program focuses primarily on wildland fires, but also has a limited capacity to fight structural fires. The USFS has cooperative agreements with the National Park Service and the California Department of Forestry and Fire Protection (CDF) to provide additional fire-fighting services. Engines which could provide fire-fighting assistance to the project area are stationed at Lava Beds National Monument, the Klamath National Refuge, and the CDF offices in Macdoel and Happy Camp (CDF 2008). All of these agencies are primarily equipped to fight wildland fires. Siskiyou and Modoc Counties can provide additional fire-fighting services for structural fires on the forest (BLM 2002).

### **3.12.3 ENVIRONMENTAL JUSTICE**

President Bill Clinton issued Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, on February 11, 1994. It calls for federal agencies to recognize minority and low-income groups that may be disproportionately affected by federal policies and programs. Adverse effects on health and environment should be considered under EO 12898.

The per capita income in Siskiyou County, California was \$28,306 and 17.5% of its residents lived in poverty (BEA 2006, CPEC 2005). The median household income of Siskiyou County was less than that of the average California household, and less than that of the average US household. The percentage of individuals living in poverty was also higher than the percentage of individuals living in poverty in California or the United States. Minorities, including African American, Asian, and Native American populations, are present in Siskiyou County (see Table 3.12-1) and the vicinity of the project area.

# 4: ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

## 4.1 Introduction

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This section of the EA provides an analysis of expected environmental consequences of the proposed action and alternatives. For each effect, the level of significance is discussed and mitigation proposed to reduce adverse effects.

The critical elements of the human environment have been addressed throughout this document. The proposed project will not affect certain critical elements because they do not exist in the project area. The project will not affect:

- Areas of Critical Environmental Concern
- Prime or unique farmlands
- Wastes, Hazardous or Solid
- Wild and scenic rivers

The following topics are addressed in this analysis of effects, corresponding to the Affected Environment sections presented in Chapter 3.

- Geology, Soils, and Seismicity
- Water Resources and Water Quality
- Cultural Resources and Native American Concerns
- Biological Resources (Invasive, Non-native Species; Migratory Birds; Threatened and Endangered Species)
- Visual Resources
- Land Use and Recreation (Wilderness)
- Traffic and Transportation
- Air Quality
- Noise



- Human Health and Safety and Hazardous Materials
- Socioeconomics and Environmental Justice

Each of the environmental analysis sections presents discussions on the potential effects of the proposed project on the environment. For each potential effect, a determination is made as to whether or not the proposed project would result in an adverse environmental effect. Mitigation measures to be considered as project conditions are identified to reduce or eliminate adverse effects. This chapter also includes a section describing the unavoidable adverse impacts that would occur as a result of the proposed project.

## 4.2 Geology and Soils

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### 4.2.1 PROPOSED ACTION

#### Physiography and Topography

The project area includes considerable topographic relief. The project as proposed; however, would not require any alteration of topography. Equipment installation would require minimal digging and trenching, limited to a few inches to a few feet for MT surveys. Soils would be stockpiled and replaced immediately after each survey station recording is taken. Some stations may be located on steep slopes and in areas off of existing roads. These stations would be accessed by men on foot carrying equipment. No alteration of the topography would occur to access these locations. No adverse effects to physiography and topography would occur.

#### Geology

The project would be located in an area that has experienced historic volcanic and seismic activity; however, the proposed project would not increase the risk to human health and safety from geological hazards. The project would not include construction of any permanent structures that could be adversely affected by seismic activity.

The project area includes some unique geologic features, such as rhyolitic glass flows, that are designated as Special Interest Areas (SIAs) by the USFS. Lease stipulations require that any activities related to geothermal development must not affect unique lava fields and geologic features, such as the glass flows. The lease area contains several. SIAs, such as:

- Little Glass Mountain
- Medicine Lake Glass Flow
- Fourmile Hill Tree Molds
- Pumice Craters
- Glass Mountain

No surveys would occur in the SIAs according to Mitigation Measure Geology-1. Adverse impacts to geologic features would not occur.

#### Soils

The project would have minimal potential to impact soils. Only existing unpaved roads would be used by vehicles. No off-road access would be allowed.

Soils would be disturbed by crews walking to survey locations, and crews burying the MT survey equipment. Crews would be traveling by foot from the access road to the survey locations, which would disturb the soil surface to no greater an extent than hikers or other large animals. Disturbance

may include leaving shoe imprints in the ground and transfer of soil over short distances. This impact is not adverse.

Crews would temporarily bury electrodes during the MT surveys. Depending on the type of electrode buried, the measurements of the hole can range from 6- to 12-inches deep by 6 inches wide to 18 inches deep and fewer than 6 inches wide. Crews would also bury two horizontal magnetometers in trenches that would measure 48 inches long by 6 inches deep, and one vertical magnetometer in a hole that would be 24 inches deep. The excavation of soil for burial of MT survey equipment could increase erosion of soils from survey areas. Soil that is loose is more easily erodable. Mitigation Measure Geology-2 would be implemented to preserve the visual integrity of the ground surface and prevent erosion. Mitigation Measure Geology-3 would require that broken vegetation be left in place to form a protective layer over the loosened soil. Implementation of these measures would minimize potentially adverse impacts.

### **Mineral Resources**

Several active small rock quarries are located within the project area. Some of the surveys could be located in a rock quarry. To avoid adverse effects, Mitigation Measure Geology-4 would require that no survey be placed in a quarry or gravel pit as shown on United States Geological Survey 7.5 minute quadrangles. The ground disturbance associated with the project area is minimal and would have no adverse impacts on mining operations. Cables would not extend across roads and access to the quarries would not be impeded. The project would not have any adverse impacts on mineral resources.

The proposed action would not have any impact on the geothermal resource in the project area. The geophysical surveys are passive methods used to infer where the reservoir may be located and would have no impact on the reservoir. The surveys do not include any drilling and would not access or impact the geothermal reservoir.

### **Mitigation Measures**

**Mitigation Measure Geology-1:** No survey facilities shall be placed in a Special Interest Area (*i.e.*, Little Glass Mountain, Medicine Lake Glass Flow, Fourmile Hill Tree Molds, Pumice Craters, or Glass Mountain).

**Mitigation Measure Geology-2:** Workers shall stockpile soil excavated for the purpose of installing survey equipment. The stockpiled soil shall be used for reclamation of the small excavations immediately after completion of the survey station data gathering. Any soil replaced in an excavated hole shall be compacted to prevent erosion.

**Mitigation Measure Geology-3:** Any broken vegetation shall be left in place to maintain a protective cover of litter to prevent increased soil erosion and to encourage revegetation.

**Mitigation Measure Geology-4:** No survey shall be placed in quarry or gravel pits as mapped on United States Geological Map 7.5 minute quadrangles within the lease area.

### **4.2.2 NO ACTION ALTERNATIVE**

Under the No Action Alternative, Calpine would not perform the geophysical surveys. There would be no impacts to geology; however, greater impacts could occur if further exploration was to occur and more exploration wells were needed.



## 4.3 Water Resources and Water Quality

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### 4.3.1 PROPOSED ACTION

#### Surface Water Hydrology

The project would not result in the alteration of any existing surface waters. Surface waters in the project vicinity include:

- Bullseye Lake
- Blanche Lake
- Paynes Springs
- Schonchin Spring
- Little Medicine Lake
- Medicine Lake
- Paynes Creek
- Unnamed creek
- Unnamed spring

None of the surveys would be conducted in or cross over waterways. Drainage patterns would not be altered as impacts would be temporary and limited to just a few inches to a few square feet of disturbance for each station. Disturbance would be reclaimed immediately after collecting data and removing equipment from stations. Impacts to surface water bodies would not occur.

#### Groundwater Hydrology

No groundwater would be utilized for the proposed action. Because the groundwater table is at least 200 feet below ground surface, the minimal excavations required are too shallow to reach the groundwater table. The project would not require the use of groundwater. No impacts to groundwater are anticipated from the proposed action.

#### Water Quality

##### Surface Water Quality

Surface water could potentially be affected if loosened soil or fuel were to enter the surface drainage systems in the project vicinity.

Preventing the uncontrolled release of fuels and ensuring that loosened soil does not enter drainage pathways would avoid potential impacts to surface water bodies. Though a fuel spill from a crew's truck is unlikely, Mitigation Measure Water Resources-1 would require that all crew vehicles be inspected for fuel and other fluid leaks prior to commencing work on the project. In addition, crew members would be informed of how to recognize a fluid leak, and to report it to Calpine, BLM, and the USFS, according to Mitigation Measure Water Resources-2.

Increased sediment levels caused by increased erosion could affect the turbidity, clarity, and general water quality parameters of surface water bodies. Mitigation measures have been identified to reduce the possibility of increased erosion. Mitigation Measure Biology-1 would require that crews avoid trampling vegetation. This measure would ensure that vegetation persists and is able to hold soil in place, preventing erosion. Mitigation Measure Geology-1 would require that crews replace excavated soil with the original soil and pack it down to prevent erosion. Mitigation Measure Geology-2 would require that any broken vegetation is left in place in order to provide a protective

ground cover. Implementation of these measures would avoid any potential for adverse impacts to surface waters from erosion. Possibility of water contamination with sediment or other material is also dependent on distance of a survey to a water body. Surveys would not be allowed within 600 feet of a standing water body, spring, or stream, as shown on the United States Geological Survey 7.5 minute Quadrangles, per Mitigation Measure Water Resources-3. No surveys would occur in or cross any water bodies or drainages.

### **Groundwater Quality**

The project would not cause impacts to or use groundwater and would have no impacts on groundwater quality.

### **Mitigation Measures**

**Mitigation Measure Water Resources-1:** All vehicles that would be used on unpaved roads within the Shasta-Trinity, Modoc, or Klamath National Forests shall be inspected for fuel or other fluid leaks prior to commencing work on the proposed project.

**Mitigation Measure Water Resources-2:** Crew members shall be informed of how to recognize a fluid leak from vehicles used on the project, and to report it to Calpine and the BLM for proper clean up and abatement.

**Mitigation Measure Water Resources-3:** Surveys shall not be allowed within 600 feet of a standing water body, spring, or stream, as shown on the United States Geological Survey 7.5 minute Quadrangles.

### **4.3.2 NO ACTION ALTERNATIVE**

Under the No Action Alternative, Calpine would not perform the geophysical surveys. There would be no impacts to hydrology; however, greater impacts related to erosion could occur if further exploration was to occur and more exploration wells were needed.

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## **4.4 Cultural Resources and Native American Concerns**

### **4.4.1 PROPOSED PROJECT**

#### **Introduction**

#### **Definition of Adverse Effects**

Federal law requires the consideration of effects to historical and cultural resources prior to authorizing any activity. 36 CFR 296 (Protection of Archaeological Resources) and 36 CFR 800 (Protection of Historic and Cultural Properties) provide guidelines for the protection of cultural resources. A proposed action would be considered to have an adverse effect on cultural resources if it adversely affects a resource listed or determined to be eligible for listing on the National Register of Historic Places (NRHP).

In addition, a proposed action would be considered to have an adverse effect if it would significantly interfere with or disrupt American Indian uses of an area. The American Indian Religious Freedom Act (PL 95-341) states that it is "...the policy of the United States to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian...including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites". The proposed project would have an adverse effect if it were inconsistent with this policy.



Section 106 of the National Historic Preservation Act defines the following criteria of adverse effect to sites on or eligible for listing on the National Register of Historic Places as occurring “under conditions which include but are not limited to”:

- Destruction or alteration of all or part of a property
- Isolation from or alteration of its surrounding environment
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting
- Transfer or sale of a Federally owned property without adequate conditions or restrictions regarding preservation, maintenance, or use
- Neglect of a property resulting in its deterioration or destruction

#### **Methodology for Assessing Effects**

The impact assessment for cultural resources and traditional cultural values is based on:

- Information collected for the Fourmile Hill and Telephone Flat Geothermal Development Projects
- Guidelines and management goals from the Forest Plans
- Guidelines and management goals from the Medicine Lake Highlands HPMP
- National Historic Preservation Act of 1996, as amended
- American Indian Religious Freedom Act of 1978
- Executive Order 13007, Sacred Sites
- Executive Order 12898, Environmental Justice
- Native American Graves Protection and Repatriation Act
- National Environmental Policy Act

The project area is located within the Medicine Lake Highlands area, which is governed by the Memorandum of Agreement between the USFS, BLM, SHPO, and the Advisory Council on Historic Preservation.

The Medicine Lake Highlands, generally bounded by the 6,000 foot elevation contour, is considered as eligible for listing in the National Register of Historic Places as a Traditional Cultural Property District (USFS et al. 2008). The District was determined eligible to the National Register under criterion “A” as it is associated with events that have made a significant contribution to the broad patterns of our history and to events that have made a significant contribution to the cultural traditions of a community. As a cultural landscape, the area around Medicine Lake met Criterion A for its association with a pattern of events, both mythical and historical, as evidenced by the testimony of members of the Modoc and Pit River Tribes as well as other northern California tribes. Two major themes are present:

- 1) Traditional Indian spiritual beliefs and practices, and
- 2) Patterns of Indian economy and settlement (Hitchcock 1999).

The project has been assessed for its potential to impact known and unknown cultural and historic resources, as well as the eligibility of the Medicine Lake Highlands under Criterion A, and for general impacts to traditional cultural values.

## Potential Effects

### Prehistoric and Historic Resources

Previous surveys and excavations have produced few chronologically sensitive prehistoric artifacts in the Medicine Lake Highlands area (BLM et al. 1995). Records searches and survey work has been conducted in the project area as part of previous projects. The result of previous survey work is presented in the 1996 Fourmile Hill EIS and the 1999 Telephone Flat EIS.

Not all areas within the Highlands have been subjected to Class III surveys. The project therefore has some potential to impact both known and unknown archaeological and historic resources. The project includes minimal ground disturbance; however, excavation of any type has some potential to impact cultural resources. Excavation for the geophysical surveys would be limited to a few square inches to a few square feet and would be performed by hand. An archaeological monitor would travel with the survey crew and inspect all areas prior to ground disturbance. The survey area would be moved to avoid any and all resources. Placement of cables on the ground surface would not have any potential to impact prehistoric or historic resources. Additional mitigation requires that the monitor investigate and identify all previously discovered resources prior to entering the field to ensure that the resources are avoided. Potentially adverse impacts to archaeological and/or historic resources would not occur through implementation of mitigation.

Although highly unlikely, if human remains are discovered during project activities, adverse impacts could occur. Mitigation requires that if human remains are discovered, all work within 300 feet of the remains would cease and would be protected from further exposure or damage until evaluated and the procedures of 43 CFR Part 10, Native American Graves Protection and Repatriation Regulations are implemented.

### Native American Traditional Cultural Values

#### *Eligible Properties under the NHPA*

The proposed project would occur within an NRHP eligible District as defined in the NHPA. The project as proposed is temporary in nature and would not alter the landscape or the values of the property such as to impact the eligibility of the property for the NRHP. The project would not result in alteration of all or part of the property; isolation from or alteration of its surrounding environment; introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting; transferring or selling of the Federally owned property without adequate conditions or restrictions regarding preservation, maintenance, or use; or neglect of the property resulting in its deterioration or destruction (all stipulations for eligibility under Criterion A).

#### **Access to Sacred Sites Under Executive Order 13007**

Executive Order 13007 (1996) states:

“(a) In managing Federal lands, each executive branch agency with statutory or administrative responsibility for the management of Federal lands shall, to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions,  
(1) accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and (2) avoid adversely affecting the physical integrity of such sacred sites. Where appropriate, agencies shall maintain the confidentiality of sacred sites.”

Sacred sites are defined in the act:

“Sacred site” means any specific, discreet, narrowly delineated location on Federal land that is identified by an Indian tribe or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or



ceremonial use by an Indian religion, provided that the tribe or appropriate authoritative representative of an Indian religion has informed the agency of the existence of such a site.”

The proposed project would not prevent access to or ceremonial use of Indian sacred sites by Indian religious practitioners. Roads would not be blocked and surveys require minimal to no ground disturbance and are temporary. The presence of a survey location is no longer evident after the wires and cables are removed. There would be no permanent impacts to any areas within the highlands. The project would not conflict with Executive Order 13007.

#### ***Values Identified in the Medicine Lake Highlands HPMP***

Geothermal development and associated activities has been identified in the Medicine Lake Highlands HPMP as having an adverse impact on the spirituality of the area. The HPMP identifies several values that should be considered during project planning in the Highlands in order to minimize these adverse effects. Table 4.4-1, below lists each of the relevant values and describes how the proposed project would not have an adverse effect on the value and/or how any adverse impacts could be mitigated and minimized. The table also includes stipulations A through F from Section II (Resolution of Project Effects) of the MOA (as amended in 2005). Stipulations G through M would also be implemented as appropriate. These stipulations include the requirement for mitigation monitoring, reclamation bonding, and contingencies. The analysis presented in Table 4.4-1 is in compliance with the *Proposed Interim Guidelines for Addressing Traditional Cultural Values of the Medicine Lake Highlands Relative to Environmental Analysis And Section 106 NHPA Determination of Effect* revised July 17, 2002 per April 9, 2002 consultation meeting with Pit River Tribe and May 20, 2002 consultation meeting with Klamath Tribes (Guidelines) (Appendix D of this EA). The MOA is presented in Appendix C of this EA. The Section 106 Consultation findings also recognized a potentially adverse effect to Native American Spirituality; however, this effect has been addressed at length in previous NEPA documentation (i.e., Fourmile Hill EIS, Telephone Flat EIS) and is minimized through implementation of the stipulations in the MOA and the Guidelines. The project is in compliance with several legal requirements regarding use of geothermal leases, renewable energy development, the Forest Plans stipulations for supporting multiple uses, and the HPMP management recommendations (as described in Table 4.4-1).

The values of place identified in Section 3.4 of this EA would not be physically affected by the proposed project. The project would not physically impact water places, high places, unique geologic features, or intervening areas (as described in Table 4.4-1). The project may have impacts on spiritual beliefs regarding the scientific collection of natural data and the spiritual disturbance that such endeavors may cause. Impacts are minimized as much as is feasible by the passive nature of the tests and the intent of the surveys is to minimize the extent of more invasive exploration that would be needed if geothermal exploration were to continue.

**Table 4.4-1: Project Analysis of Effects for Each Native American Traditional Value Identified in the 2008 Medicine Lake Highlands HPMP**

Resources	Project Analysis Requirements from 2000 MOA, Section II, Resolution of Effects	Project Analysis
<p><b>Air</b> in the Highlands is valued for its freshness and purity. <i>Day and night skies are clean</i> and are not obscured by pollution and other particulates. Air to breathe and smell is fresh and <i>free of un-natural odors</i>. Odors from mechanized equipment, vehicles, and other human developments are especially intrusive and adversely impact traditional uses.</p>	<p><b>Effects on Air and Water Quality.</b> The approving agency or agencies, in concert with the Siskiyou County Air Pollution Control District and the Regional Water Quality Control Board, shall ensure that the quality of the air and water in the Highlands is protected through the use of appropriate pollution control devices and measures.</p>	<p>The proposed project would not result in air quality impacts. The project is temporary in nature and requires only minimal ground disturbance for installation of electrodes and magnometers. No unnatural odors would be generated from the project. Light duty transport trucks would be used to transport crews. One to two trucks would be used per crew and would only access existing, authorized roads. The project would not impact traditional cultural values associated with air.</p>
<p><b>Water</b> in the Highlands is valued for its life giving, healing qualities. Traditionalists have referred to water as the lifeblood of the Highlands. Water is fundamental to all traditional practices in the Highlands and because <i>purity is essential</i> to waters' medicinal qualities, it should not be contaminated by pollution. Because water is naturally scarce in the Highlands, it is highly regarded and viewed as especially precious.</p>	<p><b>Effects on Air and Water Quality.</b> The approving agency or agencies, in concert with the Siskiyou County Air Pollution Control District and the Regional Water Quality Control Board, shall ensure that the quality of the air and water in the Highlands is protected through the use of appropriate pollution control devices and measures.</p>	<p>The project would not have any impacts on water quality. Surveys would not be performed across any standing water bodies and mitigation would require that the surveys are conducted at least 600 feet from standing water bodies. Impacts to traditional cultural values associated with water would not occur.</p>
<p><b>Forest health</b> is valued for its contribution to the spiritual atmosphere of the Highlands. In essence, forest health means spiritual health. <i>In a healthy forest, the vegetation is structurally and biologically diverse. Forests contain un-even aged stands and diverse understory communities essential for wildlife habitat, functional riparian zones and traditional plant species.</i> Forest, or ecosystem, health is a spiritual requirement. If the ecosystem becomes contaminated, then spiritual values are damaged or lost. To the local Indians, natural resources are considered cultural resources; they cannot be separated. Therefore, values associated with natural resources are considered by local Indian communities to be contributing elements of a sacred landscape as well as a historic property as defined by the National Historic Preservation Act.</p>	<p><b>Effects on Plants and Wildlife.</b> To the extent practicable and in consultation with the Tribes and Coalition, the approving agency or agencies shall ensure that necessary baseline data are collected on plants and wildlife communities subject to possible Project effects. The approving agency or agencies shall ensure that Project operations are designed and carried out to minimize impacts on native plants and wildlife, that disturbed land areas are appropriately revegetated, and that revegetation employs plants selected in consultation with the Tribes and Coalition.</p>	<p>The proposed project would not result in the removal of any large trees or large shrubs as described in mitigation. Physical impacts to the ecosystem would be no greater than recreationalists traveling the forest. These impacts would be temporary and all areas requiring minor excavation would be immediately reclaimed upon removal of the electrodes and magnometers.</p> <p>A botanist would travel with the survey crew to ensure that no ethonobotanical plants are disturbed during the survey work.</p> <p>The proposed project would not have an effect on forest health.</p>



**Table 4.4-1 (Continued): Project Analysis of Effects for Each Native American Traditional Value Identified in the 2008 Medicine Lake Highlands HPMP**

Resources	Project Analysis Requirements from 2000 MOA, Section II, Resolution of Effects	Project Analysis
<p>In the cultural ecology of the Highlands, the springs, trees, animals, plants, and unique landscape features have a distinct cultural value of their own because of their origin in the Highlands; they are especially valuable as they are considered an expression of the Creator's presence. As such, the botanical and animal species in the Highlands have a higher level of spiritual significance. This means that the traditional practices and lifeways associated with the gathering of food and care of the land become spiritual endeavors. Therefore, in the Indian worldview, environmental impacts are also cultural impacts since values associated with living cultural and social systems are imbedded in the land, plants, animals, air, water, setting, and beauty of place.</p>		
<p><b>Sound (natural auditory qualities)</b> in the Highlands is valued when it conveys the <i>natural noises of the forest, the wind, and the quietude</i> needed for prayer, vision, and power seeking. Noise levels should not be distracting or intrusive to the practitioners' heightened level of experience.</p>	<p><b>Auditory Effects.</b> In continuing consultation with Tribes, the Coalition, and others, the approving agency or agencies will identify locations where natural quiet is important to cultural use of the area by the Tribes. To the maximum practicable extent, the approving agency or agencies will ensure that Project activities are inaudible at each such location. Noise will be controlled through the use of mufflers, baffles, and other noise-deadening devices, through careful control of pipe and machinery handling, and through scheduling and other means developed in consultation with Calpine, the Tribes, and the Coalition. The approving agency or agencies will use the modeled noise levels on Attachment 1, dated April 10, 2000, and titled "Modeled Noise Levels Associated with Traditional Cultural Properties and Activities with the Fourmile Hill Geothermal Project," plus on-the-ground monitoring, in determining the actual effectiveness of the noise-deadening devices.</p>	<p>The survey equipment does not generate noise. The greatest source of noise would be from crew communication and that noise would be temporary in any one location and intermittent. Noise deadening devices are not required since the equipment does not generate noise. No vehicles would be driven off of authorized roads. The proposed project would not have an adverse effect on noise in the forest.</p>
<p><b>Viewsheds (and other visual qualities)</b> as seen from several culturally important buttes and mountain tops in the Highlands are</p>	<p><b>Visual Effects.</b> In continuing consultation with Tribes, the Coalition, and others, the approving agency or agencies will identify locations where</p>	<p>Visual impacts of the proposed project are temporary and very low profile. The most obvious aspect of the surveys would be the workers setting</p>

**Table 4.4-1 (Continued): Project Analysis of Effects for Each Native American Traditional Value Identified in the 2008 Medicine Lake Highlands HPMP**

Resources	Project Analysis Requirements from 2000 MOA, Section II, Resolution of Effects	Project Analysis
<p>valued for their <i>unfragmented</i>, powerful volcanic and forested landscape features that extend from horizon to horizon <i>without significant evidence of human development or commercial intrusions</i>. Practicing traditionalists often orient their activities towards other power features and alignments. <i>Unobstructed viewsheds, with unobtrusive elements in the intervening landscapes</i>, are needed in order to connect visually and spiritually from the place one stands to other power places containing unique powers sought by the practitioner. Scarred viewsheds are distracting, may interrupt traditional practices, and may diminish the power of the experience.</p>	<p>seeing Project activities or their byproducts (e.g., steam plumes, power transmission lines, pipes, etc.) may impact the cultural use of the area by the Tribes. To the maximum practicable extent, the approving agency or agencies will ensure that such activities and their byproducts are not visible from such locations, or, if invisibility cannot be achieved, that visibility is minimized. Visual impacts will be controlled through scheduling to avoid conflict with tribal use of the area, through the use of nonspecular and appropriately colored facilities and construction materials, through the use of light shrouds, through cooling tower design to facilitate dissipation, and through other means developed in consultation with Calpine, the Tribes, and the Coalition. The approving agency or agencies will use the estimated visual impacts on Attachment 2, dated April 10, 2000, and entitled "Fourmile Hill Geothermal Project Visual Impacts with Mitigation Measures," plus on-the-ground monitoring, in determining the actual effectiveness of the cooling tower design, light shrouds, and transmission line design.</p>	<p>up stations. Wires would be placed on the ground and would only be visible within a few feet. Other equipment is about the size of a briefcase and would not obstruct views or be visible from distances greater than a few feet away. Workers may need to wear florescent vests according to safety protocol; however, the duration of worker presence would be a few hours as workers move to survey areas and would take about an hour at each survey area for set-up and an hour for take-down. No permanent structures would be constructed as part of the proposed project. The project would not have adverse impacts to traditional cultural viewsheds.</p>
<p><b>Traditional uses of and beliefs about the Highlands</b> are valued because they are central to the identity and survival of the American Indian communities that revere the Highlands. Beliefs and practices associated with the Highlands are derived from origin stories, the passing down of cultural knowledge from generation to generation, as well as an individual's personal spiritual experience. The Highlands, and its center at Medicine Lake, is a legend place. Stories tell how Creator bathed in the lake and created Obsidian people at Glass Mountain. It is believed today that Old Man Creator comes down from Mount Shasta and bathes in Medicine Lake. Creator's spirit is, therefore, imbued in the mountains, buttes, and other natural features throughout the Highlands.</p> <p>Important cultural teachings are</p>	<p>N/A</p>	<p>The project would maintain the natural appearance and state of the project area. Minimal excavation would be required to install some equipment. Excavation would be no greater than that which may be created by a recreationalist or animals. All areas would be immediately reclaimed upon completion of surveys in each area. The natural setting of traditional practices would not be adversely impacted. Survey locations may be moved as necessary and would not be established in site of any individuals in traditional practice. Human presence in each survey location would only last up to an hour for setup and an hour for breakdown. Some survey equipment may be left overnight but would not be visible unless in the immediate vicinity of the equipment. The geophysical surveys would not have physical impacts on traditional practices.</p>



**Table 4.4-1 (Continued): Project Analysis of Effects for Each Native American Traditional Value Identified in the 2008 Medicine Lake Highlands HPMP**

Resources	Project Analysis Requirements from 2000 MOA, Section II, Resolution of Effects	Project Analysis
<p>derived from the ancient stories passed down from generation to generation regarding events and spiritual beings associated with the volcanic landscape of the Highlands. Significant events revolve around explanations for geomorphic features and volcanism. For example, the teachings are displayed in the stories about the actions of Creator, Old Man Flint, and Coyote. To go to the Highlands is to get closer to Creator. Local Indians today journey in the Highlands to experience the presence of their ancestors; to see, feel, and experience the same spiritual qualities as the ancient ones did. One goes to the Highlands to leave worries behind. They go to connect to their origins and replenish their spirit. <i>The natural setting within which traditional practices are conducted should be maintained or managed for conservation or enhancement of cultural qualities.</i></p>		
<p><b>Spiritual values</b> in the Highlands are directly tied to the <i>health of all the components of the ecosystem</i>. Ecosystem health is critical to maintain spiritual values. The spiritual quality of the Highlands sustains the traditional culture of the communities that revere the Highlands. Currently, spiritual qualities are considered by many tribal members to be nearing their threshold of cultural integrity due to increases in recreational uses, numbers of people, expanded roaded areas, off road motorized uses, and motorized boat use on Medicine Lake. Proposed geothermal developments are believed to "...threaten the collapse of spirit for the area...." (Theodoratus et al 1998).</p> <p>Cultural preservation in the Highlands means <i>protecting the spiritual atmosphere of purity and remoteness</i>. The well-being, or spiritual health of the Highlands, is closely related to the improvement in other areas of tribal life, including physical and psychological health, general welfare, cultural revitalization, and livelihoods. Because the Highlands serve as a</p>	<p>N/A</p>	<p>The project would not impact the health of the ecosystem in the project area. Physical impacts to the ecosystem would be no greater than recreationalists traveling the forest. These impacts would be temporary and all areas requiring minor excavation would be immediately reclaimed upon removal of the electrodes and magnometers.</p> <p>The project may be considered by tribal members to have impacts on spiritual beliefs regarding the scientific collection of natural data and the spiritual disturbance that such endeavors may cause. Impacts are minimized as much as possible by the passive nature of the tests and the intent of the surveys is to minimize the amount of more invasive exploration that would be needed if exploration were to continue.</p>

**Table 4.4-1 (Continued): Project Analysis of Effects for Each Native American Traditional Value Identified in the 2008 Medicine Lake Highlands HPMP**

Resources	Project Analysis Requirements from 2000 MOA, Section II, Resolution of Effects	Project Analysis
sanctuary, there is a direct link between the health of tribal communities and the spiritual condition of the Highlands as a whole.		
<p><b>Relationship to other traditional cultural properties.</b> Like the Highlands, Mount Shasta, situated approximately 20 miles west of the Highlands, has been determined eligible to the National Register of Historic Places as a Traditional Cultural Property for its association with events that have made a significant contribution to the cultural traditions of a community. Theodoratus et al. (1998) explains that the Pit River people view the Highlands region as a tightly interconnected series of features extending west to Mount Shasta. Geographically, the two places are linked since the Highlands are considered an easterly projection of the Cascade Range into the Modoc Plateau. Beyond this geographical link, the key relationship between Medicine Lake and Mount Shasta lies in legend. Ancient stories tell how Mount Shasta is the “head mountain,” since it is home of Creator. From Mount Shasta, Creator would travel to rest and bathe in Medicine Lake. The <i>Obsidian People</i> story links the two places as it tells how Mount Shasta stopped the killing by the Obsidian People who lived at Glass Mountain.</p> <p>Timber Mountain, Lava Beds, and Dry Lake Beds have all been identified by local Indians as important cultural places. Timber Mountain, located approximately 15 miles northeast of the Highlands, has been determined eligible to the National Register as an archaeological district that demonstrates traditional cultural importance to the Tribes (Gates 1999). Lava Beds, located about 10 miles north of Medicine Lake, and Dry Lake Beds, located about 20 east, are both potentially eligible properties due to their association with historic events (Modoc War) and archaeological values.</p> <p>The Highlands is connected</p>	<p><b>Effects on Access.</b> In accordance with E.O. 13007, the approving agency or agencies shall ensure that Tribes are afforded free and unrestricted access to public lands in the Highlands, including the Project area, to the extent permitted by safety considerations and resource protection needs, and to the extent consistent with applicable laws and regulations, before, during, and after the life of the Project.</p>	<p>The project would not have physical effects on other traditional cultural properties outside of the Medicine Lake Highlands and it would not obstruct or affect routes between these places.</p> <p>The project as proposed would not block or prevent access to any of the public areas in the Highlands.</p>



**Table 4.4-1 (Continued): Project Analysis of Effects for Each Native American Traditional Value Identified in the 2008 Medicine Lake Highlands HPMP**

Resources	Project Analysis Requirements from 2000 MOA, Section II, Resolution of Effects	Project Analysis
<p>geophysically to these important places by volcanic events where the high elevation mountains, buttes, glass flows, and cinder cones of the Highlands landscape transition into the lower elevation scablands of the Modoc Plateau. Ethnographic studies (Theodoratus 1998 and Deur 2003) reveal information regarding the linkage of the places in terms of travel routes between destinations. The Highlands are also linked to the Lava Beds as it served as sanctuary to the Indians during the Modoc War. Therefore it is especially important that these cultural places and historic properties be managed in such a way as to protect their archaeological and traditional cultural values.</p>		
<p><b>Medicinal and other native plants</b> are valued for their healing, medicinal, nutritional, and utilitarian qualities. The <i>health, viability,</i> and populations are monitored by practitioners as indicators of the overall health of the Highlands ecosystem. Plant and animal life play an important part in both spiritual and cultural significance, for they are not interchangeable with plants or animals found outside the Highlands. In other words, they are especially valued because of their origin in the Highlands.</p>	N/A	<p>The proposed project would not result in the removal of any large trees or large shrubs as described in mitigation. Physical impacts to the ecosystem would be no greater than recreationalists traveling the forest. These impacts would be temporary and all areas requiring minor excavation would be immediately reclaimed upon removal of the electrodes and magnometers. Disturbance is very minimal and evidence of disturbance would be indiscernible after the survey equipment is removed.</p> <p>A botanist would travel with the survey crew to ensure that no ethonobotanical plants are disturbed during the survey work.</p>
<p><b>Archaeological research</b> is not highly valued by the tribes, although recent archaeological investigations have provided important information regarding ancient uses, including trade of obsidian resources, in the Highlands. Generally speaking, archaeological investigation is viewed as exploitive and destructive. The tribal perspective is that <i>living cultural values should not be compromised by the destruction of cultural sites through excavation</i> by the scientific community. <i>Ethnological, ethnohistoric, and ethnographic research and documentation are</i></p>	<p>In consultation with the SHPO, Tribes, the Coalition, and Calpine, the approving agency or agencies shall ensure that archaeological sites subject to direct (e.g., well drilling, construction) and indirect (e.g., artifact collecting, vandalism) effects resulting from the Project are identified, and that the sites are protected from such effects. Protection shall be achieved through such means as Project design, relocation of Project facilities, and site burial.</p>	<p>Additional archaeological survey work is not proposed. Effects to archaeological resources would be avoided through use of an archaeological monitor during survey implementation. Mitigation requires training regarding the cultural and archeological sensitivity of the Medicine Lake Highlands working on the proposed project for all crew members.</p> <p>Cultural resources sites would be avoided; mitigation or data recovery would not be required for the proposed project.</p>

**Table 4.4-1 (Continued):** Project Analysis of Effects for Each Native American Traditional Value Identified in the 2008 Medicine Lake Highlands HPMP

Resources	Project Analysis Requirements from 2000 MOA, Section II, Resolution of Effects	Project Analysis
<i>viewed as important if conducted in a sensitive manner and for reasons that benefit the culture and heritage programs of the tribes</i>		
<p><b>Specific historic properties</b> are valued for their unique function and place in the spiritual cosmology of the Highlands. Properties should be managed for protection and enhancement of their cultural values. Impacts from human uses, commercial uses, and development should be minimized.</p>	N/A	<p>Specific historic properties would be avoided through the use of an archaeological monitor.</p>

### Mitigation Measures

**Mitigation Measure Cultural Resources-1:** All construction crews shall be trained about the cultural sensitivities of the project region and the requirements of this EA. The applicant shall conduct employee briefings to inform personnel of requirements for compliance with the Archaeological Resources Protection Act (ARPA), the National Historic Preservation Act (NHPA) and the MOA, as amended in 2005.

All crew members shall be informed before commencement of survey operations that any effects on, defacement of, or removal and/or disturbance of archaeological, historical, or sacred material shall not be permitted. Violation of the laws that protect these resources shall be treated as law enforcement/disciplinary action.

**Mitigation Measure Cultural Resources-2:** If human remains are encountered during project operations, all work within 300 feet of the remains shall cease and the remains shall be protected from further exposure or damage.

The BLM and USFS shall be notified immediately if human remains are found. If human remains are Native American, the BLM and USFS shall follow the procedures set forth in 43 CFR Part 10, Native American Graves Protection and Repatriation Act regulations.

**Mitigation Measure Cultural Resources-3:** A botanist shall travel with the survey crew to ensure that excavation would not disturb any ethnobotanical plants.

#### 4.4.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, Calpine would not perform the geophysical surveys. There would be no impacts to cultural resources and Native American values; however, greater impacts could occur if further exploration was to occur and more exploration wells were needed. Impacts from increased number of exploration well pads and wells would likely be greater than the proposed geophysical studies.



## 4.5 Biological Resources

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### 4.5.1 PROPOSED PROJECT

#### Vegetation

The proposed off-road surveys and off-trail travel by foot may result in temporary effects on vegetation lasting for less than one year. Effects of surveys would include compressed and possible crushed or broken vegetation within the survey area and on the routes taken to reach survey areas. Mitigation Measure Geology-2 would require that any broken vegetation be left in place to maintain a protective cover of litter to encourage revegetation. Vehicles would not cause broken vegetation off of designated travel routes because vehicles would not be allowed to travel off road.

The burial of MT station equipment would result in the removal of some vegetation from land excavated to bury the MT station equipment. Implementation of Mitigation Measure Biology -1 would reduce or avoid the loss of vegetation by burial prohibiting the removal of large vegetation to bury survey equipment.

Mitigation Measure Geology-1 requires soils to be stockpiled and replaced after minor excavations. Replaced soil would facilitate regrowth of the small vegetation that may be damaged during excavation. Areas of impact from MT surveys are small, limited to a few square feet, and given the large size of the forests and the abundant vegetation available; impacts to general vegetation would not be adverse.

#### Wildlife

##### General Wildlife

The presence of humans may cause wildlife, such as small mammals and birds, to avoid the immediate survey area. Because of the nature of the area and the small scale of the proposed project, there would be abundant suitable habitat for the species to inhabit. Workers would only be located in each survey location for about an hour to set-up and break down. Wires are placed on the ground and animals would be able to freely move over and around them. Entanglement is not likely. Adverse impacts to general wildlife would not occur.

##### Key Game Species

The southern Cascade region has several important mammalian and avian game species. Executive Order 13443, Facilitation of Hunting Heritage and Wildlife Conservation, signed August 16, 2007, requires that these species be considered on federally managed lands.

Game species that may be found in the area include Rocky Mountain mule deer, pronghorn antelope, and Rocky Mountain elk. Some species could visit the project site periodically to forage or to migrate through the area. These species would not be impacted by project activities due to the large availability of migrating habitat and similar foraging habitat in surrounding areas. Surveys would only occur in locations for short periods of time (less than 24 hours) and no permanent impacts would occur.

##### Migratory Birds

Raptors would not lose the foraging habitat as a result of the proposed project; however, a few birds may temporarily avoid from areas where survey crews are active. Raptors are very mobile predators that forage over several square miles in a day. The surrounding area provides ample foraging habitat for raptors in the area.

The human presence disturbance effects would be temporary and short-term, given the short time period of the project and the small length of time that crews would be at any one survey location; therefore, nesting birds would not be impacted. Raptors would move to surrounding areas during the short project period, if disturbed. Adverse impacts are not expected.

### **Threatened, Endangered, Proposed for Listing, and Candidate Species**

Federal endangered species laws mandate protection of listed endangered and threatened species. Other special-status species include those proposed for listing or designated as species of concern by the USFWS, as well as species of special concern identified by the CDFG, the CNDDDB list, and the USFS Sensitive Plant lists. If the proposed action would affect the range of, or extirpate an endangered, threatened, or other special-status species, or result in take of such species, it would be considered a significant impact.

The management objectives for USFS sensitive species include:

- Develop and implement management practices to ensure that species do not become threatened or endangered because of USFS management actions.
- Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on USFS lands.
- Develop and implement management objectives for populations and/or habitat of sensitive species.

USFS policies regarding sensitive species include reviewing programs and activities through NEPA for their potential effect on sensitive species, and avoiding and minimizing impacts to sensitive species. If the proposed action would conflict with any of the above USFS policies, it would be considered a significant impact.

### **Special Status Plant Species**

Several special status plant species are likely to occur in the proposed project area. There is suitable habitat for:

- Pyrola-leaved buckwheat (*Eriogonum pyrolifolium* var. *pyrolifolium*)
- Little hulsea (*Hulsea nana*)
- Oregon sedge (*Carex halliana*)
- Talus collomia (*Collomia larsenii*)
- Snow fleabane daisy (*Trimorpha acris* var. *debilis*).

To avoid damage to any special status plants in the process of completing the surveys, Mitigation Measure Biology-3 would be implemented. The measure requires a botanist to clear all excavation areas to ensure no special status plants are impacted by the excavation. Mitigation Measure Cultural Resources-5 also requires that ethnobotanical species are not disturbed during excavation to temporarily install MT equipment.

### **Special Status Wildlife Species**

The likelihood of encountering suitable habitat for a special status animal species is very high because of the multiple locations of the surveys. The habitats of the northern spotted owl (*Strix occidentalis caurina*), northern goshawk (*Accipiter gentilis*), and the bald eagle (*Haliaeetus leucocophalus*) could be affected by the survey crews. Habitat could only be impacted by crew noise. The actual survey work would involve minimal ground disturbance and no direct impacts to trees, nests, or individual birds. Noise would be minimal and adverse impacts to avian species would not occur.



Other special status mammals include the:

- Sierra Nevada red fox (*Vulpes vulpes nicator*)
- Fisher (*Martes pennanti*)
- Taylor pika (*Ochotona princeps taylori*)
- American marten (*Martes Americana*)
- Western mastiff bat (*Eumops perotis californicus*)
- Long-eared myotis (*Myotis evotis*)
- Silver-haired bat (*Lasionycteris noctivagans*)

These species may occur in the project area, but would avoid the immediate area of the survey, or be unaffected by the human activity in the area. The avoidance would be temporary and there is suitable habitat surrounding the proposed survey areas. Adverse impacts to these species would not occur. No mitigation measures are required.

### **Invasive, Nonnative Species**

There is a potential for the spread of invasive/non-native species whenever construction equipment, vehicles, and crews enter a new project site. The invasive species seeds can become attached to vehicles, equipment, and clothing. They could be spread by traveling to different locations after attaching to vehicles, equipment, or crews working on the surveys. To avoid the spread of invasive species, equipment must be cleaned and crew clothing must be cleared of vegetation and soil per Mitigation Measures Biology-3 and -4.

### **Mitigation Measures**

**Mitigation Measure Biology-1:** Survey crews shall avoid, when possible, placing holes for MT survey equipment in a location that would require the removal of larger shrubs or trees. Removal of small shrubs and grasses is allowed.

**Mitigation Measure Biology-2:** A certified botanist shall travel with the field crew to ensure that special status plant species are not excavated for the burial of probes or other equipment. Equipment shall be moved to avoid special status plant species.

**Mitigation Measure Biology-3:** All equipment, including vehicles and survey equipment, shall be cleaned and rinsed to remove weed seed and soil (which may contain weed seed) before moving vehicles from one survey site to another, prior to commencing operations on lands within the project area, and before changing the location of survey equipment.

**Mitigation Measure Biology-4:** Crew members shall wipe off the bottom halves of their pant legs, and hose down soles of shoes to remove weed seed and soil (which may contain weed seed) prior to commencing operation on lands within the project area or changing the location of survey equipment.

### **4.5.2 NO ACTION ALTERNATIVE**

Under the No Action Alternative, the BLM and the USFS would not allow the completion of geophysical surveys on Calpine leased lands. There would be no impacts to biological resources as a result of the no action alternative; however, greater impacts from expanded exploration could occur.

## 4.6 Visual Resources

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### 4.6.1 PROPOSED PROJECT

#### Effects to the Regional Viewshed

The scale of the proposed project is very small. A crew would usually be accompanied by one vehicle (up to two for safety). The crew, vehicle, and equipment would not be visible from distances. All equipment placement would be temporary. Effects to the regional viewshed would not be adverse, and no mitigation would be required.

#### Local Impacts

The visual features of the proposed project are small in scale. The visual components of the proposed project would include up to two vehicles, a crew of workers, wires, and small equipment, such as transmitters. During placement of MT equipment, the crew would be noticeable to people in the immediate vicinity of the survey area. The crew would leave the area after the equipment is installed. The above-ground equipment may be visible to people in the immediate vicinity (i.e., within 20 feet of the equipment). The crew would return at a later time to remove the equipment. Installation would require a crew to be in the area for 20 minutes to one hour, and removal would take about 30 minutes. During placement of TDEM equipment, the crew would be visible to people in the immediate vicinity of the survey area. The crew would remain for the duration of the survey, which would last up to two hours. In both the TDEM and MT surveys, the presence of crews and survey equipment would be temporary and comparable to a recreationist visiting the area. The effect of crews on the local visual setting would not be adverse.

The project vehicles would disturb dust on existing roadways, and the dust plume would be visible for a short period of time. Mitigation Measure Traffic-1 would require vehicles to maintain speeds at 15 mph (where no speed limit is posted) to minimize dust plumes. There would be no lasting disturbance from the project. No evidence of the survey would remain after the survey. Native Americans in traditional practice may be particularly sensitive to views of workers and equipment; however, workers would only be present in areas for short periods of time, usually on the order of a few hours and would be otherwise moving throughout the forest. Visual impacts would be similar to hikers or forest service personnel doing work in the forest (i.e., invasive species removal projects).

#### Management Goals

The USFS Visual Management System is used to evaluate visual effects from projects on Forest Service lands.

Most of the proposed survey sites are located on lands designated as "Partial Retention" under the Visual Management System. In areas designated Partial Retention, management activities of landscape and landform alterations must remain visually subordinate to the characteristic landscape, that is, they must not draw attention away from the characteristic landscape.

Projects that temporarily introduce contrasts in color, line, form, or texture are allowed, but must be reduced to meet "Partial Retention" classification within one year of a project undertaking. The MT surveys would involve a few workers and up to two vehicles. This effect would be consistent with the partial retention designation. The project would require small areas (up to 10 square feet) of excavation, as described in Section 2.3 Proposed Action. Soil must be replaced per Mitigation Measure Geology-1; therefore, the alteration of the landscape would be subordinate to and not affect the characteristic landscape. In addition, the survey equipment would be placed temporarily, and would be on site for fewer than 24 hours; the time limit for restoration to Partial Retention requirements would not be violated. The small pieces of equipment have a very low profile and



would be barely perceptible when crews are not on location. Visual effects on areas designated as “Partial Retention” would not be adverse or in conflict with the classification.

Some survey sites are located on lands designated as “Modification”. In areas designated Modification, management activities of landscape and landform may visually dominate the natural characteristic landscape; however, they should borrow from natural characteristics at an appropriate scale. Any contrasts in color, line, form, or texture must be reduced to meet modification standards within one year. The MT surveys would involve small areas of excavation, as described in Section 2.3 Proposed Action. Soil would be replaced per Mitigation Measure Geology-1. The alteration to landscape would be considered subordinate to the characteristic landscape and not visible beyond the immediate area. Surveys are temporary and would be on site for fewer than 24 hours. The time limit for restoration to Modification requirements would not be exceeded. Visual effects on areas designated as “Modification” would not be adverse or in conflict with the classification.

Some of the proposed survey locations are on lands designated as Preservation or Retention, as shown in Figure 3.6-1. Only ecological changes and low visual-impact recreation facilities are allowed on lands designated as “Preservation”. Only management activities that are not visually evident are allowed on Retention lands. Contrasts in line, form, or color must be immediately reduced to meet Retention levels. The MT surveys would involve soil excavation. The temporary soil excavation would not be in conflict with the Preservation and Retention requirements. Survey locations that are located on Preservation-designated lands in Figure 3.6-2 would be relocated to Maximum Modification-, Partial Retention-, Retention- or Modification-designated lands, according to Mitigation Measure Visual Resources-1. This would exclude land from the perimeters of Medicine Lake, Little Medicine Lake, Blanche Lake, and Bullseye Lake. It would also exclude land from Crater Glass Flow, Medicine Lake Glass Flow, Little Glass Mountain, and Glass Mountain.

Analysis of visual resources in the context of Native American traditional cultural values can be found in Section 4.4 Cultural Resources and Native American Concerns.

### **Mitigation Measures**

**Mitigation Measure Visual Resources-1:** Surveys shall not be allowed on lands with a Visual Quality Objective of Preservation. Project activities shall not be conducted on lands on Glass Mountain and Medicine Lake Glass Flow.

### **4.6.2 NO ACTION ALTERNATIVE**

Under the No Action Alternative, Calpine would not perform the geophysical surveys. There would be no impacts to visual resources; however, greater impacts could occur under the No Action Alternative if further exploration occurred and more exploration wells were needed. The geophysical surveys are designed to minimize the number of exploration sites.

## **4.7 Land Use and Recreation**

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### **4.7.1 PROPOSED ACTION**

#### **Land Use**

The proposed action would not conflict with existing land uses in the project vicinity. The proposed action includes temporary installation of equipment on very small sites within the Modoc, Shasta-Trinity, and Klamath National Forests. Because the survey locations would be dispersed throughout the forests, there would not be an excessive concentration of activity at any one location. The activity would be low- to no-impact. Current land uses include recreational uses, Native American traditional use, summer cabins, geothermal exploration, and mining. No logging is currently occurring with the

project area. A timber sale is planned for 2010; however, this sale would not be impacted by the proposed project as the project would be completed before 2010. The proposed action would not result in a substantial alteration of the present land uses in the areas.

### Land Use Plans

Several land use plans are identified in Section 3.7 of this EA. The proposed action would be consistent with policies and management direction contained in the Land and Resource Management Plans of the Modoc, Shasta-Trinity, and Klamath National Forests, which call for multiple uses of the forests (see Table 4.7-1). Multiple use means managing resources of the USFS for a combination of uses that will benefit the users of the land while maintaining the productivity of the land and protecting the environment (EPA 2008).

<b>Table 4.7-1: Land Use Plan Management Goals Compliance</b>			
<b>Plan</b>	<b>Management Goals Applicable to the Proposed Action</b>	<b>Project Compliance Analysis</b>	<b>Compliant with LRMP</b>
Klamath National Forest Land and Resource Management Plan (USFS 2001a)	The submission of a notice of intent or plans of operation for all mineral-related activities where the potential for significant resource disturbance exists is required.	Calpine submitted a notice of intent to the BLM and the USFS in a letter dated March 4, 2008.	Yes
	A reasonable means of access, consistent with management objectives for the area, should be approved when it is determined to be incidental to the operation.	Survey crews would only drive on established USFS roads, and would travel on foot to reach survey locations.	Yes
	In Retention and Partial Retention Management Areas, reasonable mitigation measures should be incorporated into approved plans of operation to meet the designated visual quality objectives.	Visual effects on areas designated as "Partial Retention" and "Retention" would not be adverse or in violation of the classification. Reduction in visual context would occur in a timeframe consistent with that required for activities in these areas.	Yes
	In Special Interest Areas, review plans of operation and require operations to rehabilitate ground-disturbing activities.	No surveys would take place in Special Interest Areas under Mitigation Measure Geology-1.	Yes
	Approval of plans of operation or notices of intent shall incorporate steps to minimize detrimental effects to threatened, endangered, and sensitive species habitat.	Mitigation to reduce impacts to threatened, endangered, and sensitive species habitat is outlined in Mitigation Measures Biology-1.	Yes
	Provide for Native American needs for collection and/or use of traditional resources.	The project would not block any access to public areas within the Medicine Lake Highlands.	Yes



**Table 4.7-1 (Continued): Land Use Plan Management Goals Compliance**

Plan	Management Goals Applicable to the Proposed Action	Project Compliance Analysis	Compliant with LRMP
Modoc National Forest Land and Resource Management Plan (USFS 2001b)	Provide new energy sources by allowing wind, geothermal, solar hydroelectric, and biomass development. Accommodate development of geothermal, gas, and oil resources.	Geophysical surveys are a preliminary action to determine the location of a potential geothermal resource, although successful surveys do not always lead to geothermal development.	Yes
	Inventory and protect active goshawk territories needed to meet population targets.	Avian species would not be impacted.	Yes
	Maintain the water quality of Medicine Lake, and evaluate the potential of each project in the watershed to degrade the water quality of Medicine Lake.	Mitigation Measures Water Resources-1, -2, and -3 are designed to avoid impacts to water quality from vehicle fuel leaks and siltation caused by ground disturbance.	Yes
	Management activities should not alter the scenic and scientific values of Special Interest Areas.	No surveys would take place in Special Interest Areas under Mitigation Measure Geology-1.	Yes
Shasta-Trinity National Forest Land and Resource Management Plan (USFS 1995)	Mitigate adverse effects to heritage resources that are eligible for the National Register of Historic Places, according to direction issued by the Department of the Interior and the Advisory Council on Historic Preservation.	The Medicine Lake Highlands Traditional Cultural Property District is eligible for listing in the NRHP. The 2005 MOA, as amended, would be implemented for the proposed project to avoid effects to the property. All individual resources would be avoided.	Yes
	Analyze the potential effects of all ground-disturbing projects on sensitive and endemic plants and their habitat. Mitigate project effects to avoid a decline in species viability at the Forest level.	Impacts to general vegetative habitats are analyzed in Section 4.5. Mitigation Measures Biology-1 and -3 are designed to reduce impacts to general vegetative habitats and special status plants.	Yes
The Medicine Lake Highlands Historic Properties Management Program (USFS 2007)	Mineral and energy exploration and development are covered by existing laws and regulations. (Currently, geothermal energy development is on hold pending the outcome of litigation [for development at Telephone Flat].)	The proposed action would not necessarily result in geothermal exploration or development. Successful surveys do not always lead to full-scale geothermal development. The survey results are one factor of many that would determine whether development would occur. Other factors may include the presence of commercial temperatures and fluid flow from wells, economics of the projects, power sales contracts, etc.	Yes

SOURCE: RMT Inc. 2008

### Geothermal Lease Stipulations

Lease stipulations outline certain circumstances under which geothermal activities could occur in areas designated as no surface occupancy. However, unless Calpine can demonstrate that its proposed action would not significantly affect the unique lava fields and geological features to the Forest Supervisor, surface occupancy would not be permitted in the following areas:

- T 43 N, R 4E, MDM, Sec. 8, N<sub>1/2</sub> N<sub>1/2</sub>
- T 44 N, R 3E, MDM, Sec. 32, E<sub>1/2</sub> SE<sub>1/2</sub>

- T 44N, R 3E, Sec. 33, SW<sub>1/2</sub> W<sub>1/2</sub>

Mitigation Measure Visual Resources-1 would exclude these lands from surveys.

There are is privately-owned land within the Calpine lease area, as shown in Figure 3.7-1. Surveys are shown as near to or on privately-owned lands in Calpine's survey location map. Mitigation Measure Land Use-1 requires that any surveys that are planned on privately-owned land would be relocated to public land within the Calpine lease boundary.

With the implementation of Mitigation Measure Land Use-1, no adverse impacts to land use are expected.

## Recreation

Most areas in the vicinity of the proposed project have a ROS allocation of "Roaded Natural." Other ROS allocations in the project vicinity include:

- Mount Hoffman roadless release — Semi-Primitive Non-Motorized
- Medicine Lake Lava Flow — Primitive
- Glass Mountain Lava Flow — Primitive

The USFS analyzes impacts to recreation under the ROS classification system. This system would be applicable to the proposed project because the project is located entirely within US Forest Service managed lands. The Roaded Natural area should have a natural setting, but there may be moderate evidence of the sights and sounds of humans. Therefore, the proposed action is consistent with Roaded Natural area policies.

The Semi-Primitive Non-Motorized area should have a predominantly natural or natural-appearing environment, and there is often evidence of other recreationists. Motorized use is not allowed. There are survey locations to the west of Mount Hoffman that are within the Semi-Primitive Non-Motorized area. Mitigation Measure Land Use-2 would require that motorized vehicles not be used on roads in the Semi-Primitive Non-Motorized area to access survey locations. If it is not possible to avoid the use of roads in Semi-Primitive Non-Motorized areas, then the survey locations would be relocated to an area that facilitates access consistent with the ROS classification system policies. This mitigation measure would make the proposed action consistent with Semi-Primitive Non-Motorized area policies.

The Primitive area should have an essentially unmodified natural environment of a fairly large size. The area is managed to be free from evidence of human-induced restrictions and controls. Motorized use is not allowed. There are survey locations immediately adjacent to areas designated Primitive under the ROS system. Per Mitigation Measure Land Use-3, Calpine would ensure that these survey locations are not located in the Primitive areas.

Lease stipulations outline certain circumstances under which surveys could occur in areas designated as no surface occupancy. If the Forest Supervisor and the BLM find that occupancy of the following lands would cause significant adverse impact on ongoing recreation use, then surface occupancy may be denied:

- T 43 N, R 3E, MDM, Sec. 13, All
- T 43 N, R 3E, MDM, Sec. 14, N<sub>1/2</sub>
- T 43 N, R 3E, MDM, Sec. 15, N<sub>1/2</sub>



The proposed action consists of temporary, short-term use of the Medicine Lake area. There are four developed campgrounds in the vicinity, most of which are located on the northern and western shores of Medicine Lake. Campgrounds include:

- Medicine Lake Campground (22 camp sites)
- A.H. Hogue Campground (42 camp sites)
- Hemlock Campground (19 camp sites)
- Headquarters Campground (8 camp sites)
- Payne Springs Campground (6 camp sites)
- Bullseye Lake Campground (10 camp sites)

A survey is proposed near Hemlock and Bullseye Lake campgrounds. Mitigation Measure Land Use-4 would not allow surveys to be completed on the grounds of any campground. The proposed action would not cause significant impacts on ongoing recreational uses in any of these locations and would not impact regularly used campgrounds.

Surveys would not take place during the deer hunting season under Mitigation Measure Hazards-2. No significant, adverse impacts to hunting are expected. No significant, adverse impacts to recreation are expected with the implementation of Mitigation Measures Land Use-3 and -4.

### **Mitigation Measures**

**Mitigation Measure Land Use-1:** Surveys that are planned on privately-owned land shall be relocated to public land within the Calpine lease boundary.

**Mitigation Measure Land Use-2:** In accessing survey locations, motorized vehicles shall not be used on roadways in the Semi-Primitive Non-Motorized area. If it is not possible to avoid the use of roads in Semi-Primitive Non-Motorized areas, then the survey location shall be relocated to an area that facilitates access consistent with the ROS classification system policies.

**Mitigation Measure Land Use-3:** Surveys shall not be located within areas designated as Primitive by the ROS classification system.

**Mitigation Measure Land Use-4:** Surveys shall not be located within USFS campgrounds.

### **4.7.2 NO ACTION ALTERNATIVE**

Under the No Action Alternative, Calpine would not perform the geophysical surveys. There would be no impacts to land use and recreation; however, greater impacts to land use and recreation could occur if further exploration was to occur and more exploration sites were needed.

## **4.8 Transportation and Traffic**

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### **4.8.1 PROPOSED ACTION**

#### **Highways**

##### **Road Infrastructure**

Vehicles used by survey crews would be light-duty trucks, likely with 4-wheel drive. These vehicles would not impact the highway infrastructure. Increases in traffic volume would be minimal (as described below) and roads are rated to handle light-duty trucks without significant wear and tear on

the roads. Project activities would not require the interruption of service on any highways. There would be no effects to highway infrastructure.

### **Increases in Traffic Volume**

The proposed action would not significantly increase vehicle movements on highways. Two or three independent crews would usually operate one vehicle each for travel throughout the project area. More than one vehicle could be used if required for safe operation. The proposed action would introduce two to six vehicles to the project area and the surrounding roads for a short period of time. This effect would not be considered a substantial increase in traffic. Some highways in the region experience congestion (i.e., State Route 89 and Highway 97); however, the proposed project would not cause highway capacities to be exceeded or level of service to change to a worse rating.

### **Local Roadways**

#### **Road Infrastructure and Integrity**

Vehicles used by survey crews would include light-duty trucks, likely with 4-wheel drive. These types of vehicles are allowed to travel on forest roads, many of which were designed for use by heavy logging vehicles. The roads that would be used are designed to adequately accommodate use by vehicles. The increased traffic would not have a significant impact on the road infrastructure. No off-road travel would be permitted. No vehicle travel would occur near the Medicine Lake Glass Flow, as required in the Modoc National Forest LRMP.

The USFS recently issued a decision that effectively closed 27.8 miles of existing National Forest System roads and 6.64 miles of known roads created by unauthorized road use. Use of these roads by Calpine to access survey locations would be subject to special approval from the USFS. No adverse effects to local road infrastructure systems are expected even if use of those roads were permitted. Surveys would be conducted from light duty trucks, similar to that which the Forest Service uses. Access would not be blocked to traditional sites.

#### **Increase in Traffic Volume**

Crews would be parking vehicles for extended periods of time (hours) in order to hike to remote survey locations. Mitigation Measure Transportation-1 would require that crews park vehicles on designated roadways, but in a manner that leaves enough room for an average-sized vehicle to pass without disturbing natural areas beyond the roadway.

### **Mitigation Measures**

**Mitigation Measure Transportation-1:** Crews shall park vehicles on designated roadways, but in a manner that leaves enough room for an average-sized vehicle to pass without disturbing natural areas beyond the roadway.

#### **4.8.2 NO ACTION ALTERNATIVE**

Under the No Action Alternative, Calpine would not perform the geophysical surveys. There would be no impacts to transportation and traffic; however, greater impacts could occur if further exploration was to occur and more exploration wells were needed.



## 4.9 Air Quality

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### 4.9.1 PROPOSED ACTION

#### Fugitive Dust

Vehicles and crews would generate fugitive dust by traveling on unpaved roads. Two or three independent crews would usually operate one vehicle each for travel throughout the project area. More than one vehicle could be used if required for safe operation. The amount of particulate matter generated by transportation to and from access points for survey sites would be small, localized, and temporary. Because of the small scale of the proposed action, the emissions and particulate matter disturbed by vehicles would not violate any air quality standards. Very small amounts of fugitive dust could be generated from Excavations for MT surveys would not likely cause fugitive dust because of the small extent of excavation required (a few square inches to a few square feet per survey location). Mitigation Measure Air Quality-1 would be implemented to keep fugitive dust to a minimum. Adverse effects to air quality would not occur as a result of the proposed action.

#### Combustion Emissions

Vehicles and one small gas generator associated with TDEM surveys would emit pollutants, such as NO<sub>x</sub> and SO<sub>2</sub>. Siskiyou County is classified as attainment or unclassified for all federal air pollutants. The County is classified as nonattainment/ transitional for ozone under the state standards.

Passenger light weight trucks would be used to access the project sites, similar to large personal vehicles. All vehicles would be in compliance with EPA regulations for vehicle emissions. Air pollutant emissions from up to six light weight trucks and one potential small gasoline generator would not exceed any standards. Much of the access to individual survey sites would be performed on foot. Vehicle and/or generator emissions would not cause any of the attainment or unclassified pollutants to reach nonattainment status. No adverse effects to air quality from combustion emissions would occur as a result of the proposed action.

The Lava Beds National Monument is the closest Class 1 airshed to the proposed project sites. A Class 1 airshed is an area regulated with the strictest air resource standards. The Lava Beds area is approximately 8 miles northeast of the proposed survey sites. Winds naturally blow from the northwest to the southeast, which is the opposite direction from Lava Beds National Monument, and would further disperse project emissions. There would be no impact on the nearest Class 1 airshed would not be significant, and no mitigation measures would be necessary.

#### Air Conformity

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

#### Greenhouse Gases

Global warming is a large-scale phenomenon. Quantifying and identifying the potential effects on temperature rise resulting from an individual project is not yet possible or understood. As no guidelines or standards have been set by the BLM, determining any individual project's significance is speculative; however, the proposed project would contribute a *de minimus* amount of GHGs.

## Mitigation Measures

**Mitigation Measure Air Quality-1:** Project vehicular speeds shall be limited to 15 miles per hour on unpaved roads when speeds are not posted.

### 4.9.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, Calpine would not perform the geophysical surveys. There would be no impacts to air quality; however, greater impacts could occur if further exploration was to occur and more exploration well sites were needed.

## 4.10 Noise

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### 4.10.1 PROPOSED ACTION

#### Noise Levels

A noise effect would be considered significant if the level of noise from operation equals or exceeds 65 dBA at the lease boundary, or 0.5 miles from the source, whichever is greater, according to the BLM GRO Order No.4.

The proposed action would introduce noise from vehicles and crewmembers to the project area. The project would require two or three independent crews, each with two to five workers. Noise would be generated when crews are driving to and from access points to survey locations, when crews are traveling by foot to the survey location, and when crews are at a survey location. Most of the noise generated would be similar to that generated by other forest users.

The chief source of noise would be from crew vehicle engines. Typically, each crew would have one vehicle, unless safety requires an additional vehicle. A flatbed truck produces a maximum noise level of 74 dB at 50 feet from the source (FHWA 2008). Noise attenuates at a rate of 6 dBA for each doubling of distance from the receptor. The noise level would be 62 dBA at 200 feet from the source, which is in conformance with the threshold defined by GRO Order Number 4. The noise would be temporary and short-term. No adverse, significant effects would occur from the proposed action.

Noise from crew conversation would be about 60 dBA at 3 feet, and would therefore be in conformance with the threshold defined by GRO Order Number 4 threshold. Noise from installation of various pieces of equipment would vary, depending on the type of equipment. The post hole digger (a machine with <5 horse power used to excavate 6 to 12 inch holes) would create a noise level of about 85 dBA 50 feet from the source (FHWA 2008). Noise attenuates at a rate of 6 dBA for each doubling of distance from the receptor. At 800 feet from the source, the noise level would be 61 dBA, which is in conformance with the threshold defined by GRO Order Number 4. The noise would be temporary and short-term. No adverse, significant effects are expected from the proposed action.

The MT and TDEM equipment does not generate any noise.

#### Sensitive Receptors

Sensitive receptors include recreationalists at campgrounds, Native Americans visiting the Highlands for traditional uses, and residents at the homes on private property primarily around Medicine Lake and Little Medicine Lake.

Noise generation would be minimal and limited to vehicle noise, which is typical in the project area. Equipment would not make noise and communication amongst crew members would also be similar to that generated by groups of hikers. Equipment does not generate noise while accessing data. The

project would not have adverse noise impacts. Sensitive receptors would not experience adverse noise impacts from the project.

### **Mitigation Measures**

No additional mitigation measures would be required.

#### **4.10.2 NO ACTION ALTERNATIVE**

Under the No Action Alternative, Calpine would not perform the geophysical surveys and there would be no impacts to noise; however, greater impacts could occur if further exploration was to occur and more exploration wells were needed. Additional exploration wells would cause additional noise impacts in the forest.

## **4.11 Human Health and Safety/Hazards**

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### **4.11.1 PROPOSED ACTION**

#### **Hazardous Materials**

There are no known hazardous waste sites in proximity to the proposed project.

No hazardous waste would be generated as a result of the proposed surveys. The MT and TDEM survey equipment does not utilize hazardous materials. The only hazardous materials introduced to the area as a result of the surveys would be fluids associated with crew vehicles, such as petroleum products. Best management practices (BMPs) would include inspection of vehicles for leaks before beginning survey work. The likelihood of substantial chemical spills and discharges would be very low due to the limited amount of substances (e.g., fuels and other vehicle fluid) that would be transported through the project area.

#### **Public Safety**

Most of the proposed surveys are in areas of low public use and away from major arterial roads. Equipment for MT and TDEM surveys would not carry a live current and would not pose a significant risk of electrical shock injury to people if they encounter a survey site. Survey equipment and survey lines are placed on the ground and are small enough in size that they would not pose any risks to hikers. Survey wires would not be placed across roads to avoid conflicts with vehicle use. The project would not cause adverse safety impacts to the public would not occur.

#### **Worker Safety**

Crews would not be allowed to drive off-road to access survey sites. Some survey locations are more than 0.5 miles off of access roads. Crews would be required to hike from the access road to the survey location, and most routes would not include developed trails. Workers may have an increased potential for injury from trips and falls. Mitigation Measure Hazards-1 would require that crews be trained on protocol for responding to serious injuries. The survey equipment does not include live electrical current that could pose electrical shock hazards. Crews would wear personal protective equipment as necessary, depending on the geography of the area where equipment must be set up.

Hunting season would pose a minor risk to the safety of workers who would be at survey locations. Deer hunting is the most popular type of hunting in the Medicine Lake area, and there could be some bear hunters in the area. Deer hunting season typically lasts for two weeks in October. Because of strict requirements for deer hunting (e.g., only bucks with 2 antler points may be legally



killed), hunters must be selective in choosing a deer. Reported accidents generally involve accidental discharge of hunting rifles before beginning or after completing hunting (Figura pers. comm. 2008). Surveys would be unlikely to take place in October because the project area would be prone to snow and rain storms. To avoid accidents involving hunting, Mitigation Measure Hazards-2 would require that no surveys take place during deer hunting season. If surveys would take place in September or October, Calpine would be required to contact the California Department of Fish and Game to verify when deer hunting season would take place in order to adjust the project schedule. The project would not result in adverse impacts to workers.

### **Fire**

The proposed action would slightly increase the fire hazard in the area. The presence of people in the forested area increases the risk of human-caused fire. Potential sources of fire from the proposed project include smoking and carelessly discarded cigarettes. Potentially flammable/combustible chemicals that would be used in the proposed project include oil and fuel in vehicles.

U.S. Forest Service fire prevention regulations would be posted, reviewed, and distributed to all personnel. All local, state, and federal fire protection standards applicable to contracted survey activities would be observed. Smoking in the project area would be permitted only in designated areas, and cigarettes would be removed from the project area and properly discarded per Mitigation Measure Hazards-3. Each crew vehicle would be equipped with a fire extinguisher, which would be carried to each survey site. Crews would be instructed to report any uncontained fires to the USFS.

### **Mitigation Measures**

**Mitigation Measure Hazards-1:** Crews shall be trained on how to respond to serious injuries and emergency situations.

**Mitigation Measure Hazards-2:** No surveys shall take place during deer hunting season, which typically lasts for about two weeks in October. Calpine shall be required to contact the California Department of Fish and Game if surveys are scheduled in September or October to ensure that the survey schedule would not overlap with deer hunting season.

**Mitigation Measure Hazards-3:** Smoking shall be allowed only in designated areas, and cigarettes shall be removed from the project area and properly discarded.

#### **4.11.2 NO ACTION ALTERNATIVE**

Under the No Action Alternative, Calpine would not perform the geophysical surveys. There would be no impacts to human health and safety.

## **4.12 Socioeconomics, Public Services, and Environmental Justice**

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### **4.12.1 PROPOSED ACTION**

#### **Socioeconomics and Public Services**

The proposed project would not result in any socioeconomic changes. Surveys would take approximately five to eight weeks to complete. Conducting the surveys would not require permanent additions to the workforce in the project area.

Expenditures for equipment fuel, lodging, food and other needs would have a small, but beneficial effect to the local economy over the duration of the survey period.

The project would have only a minimal impact on nearby recreational facilities, such as hiking, if hikers encounter a survey crew; however, most survey locations would only be visible during the setup and take-down when workers are in the area.

No significant, adverse impacts to socioeconomics are expected in connection with the proposed project.

### **Environmental Justice**

Environmental justice impacts occur if there is any disproportionately high and adverse human health or environmental effects on minority or low-income populations. The project has very limited physical effects. The project is temporary and minimally invasive. Some residents are located in the vicinity of the project; however, their health and safety and the environment would not be adversely impacted by the project.

The project area is used by Native Americans for traditional cultural practices and has traditional cultural spiritual value to this group. Impacts to spiritual values are not physical or human environmental impacts, but are addressed in the previous Calpine EIS and SHPO consultations under Section 106 of the NHPA, and section 4.4 Cultural Resource and Native American Concerns of this EA.

The project would not result in adverse physical and human impacts to minority populations.

### **Mitigation Measures**

No mitigation measures would be required because no adverse impacts are expected.

#### **4.12.2 NO ACTION ALTERNATIVE**

Under the No Action Alternative, Calpine would not perform the geophysical surveys. There would be no impacts to environmental justice; however, greater impacts could occur if further exploration was to occur and more exploration wells were needed.

### **4.13 Residual Impacts**

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Residual impacts are the unavoidable impacts that remain after application of all mitigation measures to those resources where mitigation was defined. This section discusses the effectiveness of identified mitigation measures and the residual impact that the project would still have on the environment. Mitigation has been defined or identified to minimize adverse effects to the greatest extent feasible. Mitigation was defined for the following sections of this EA:

- Geology and Soils
- Water Resources and Water Quality
- Cultural Resources and Native American Concerns
- Biological Resources
- Visual
- Land Use and Recreation
- Transportation and Traffic
- Air Quality
- Human Health and Safety/Hazards

#### **4.13.1 GEOLOGY AND SOILS**

Erosion could occur as a result of the project. Mitigation Measures Geology-1, -2, and -3 would require that soil be stockpiled for filling in excavated holes, and that vegetation would be left in place. These mitigation measures would reduce the potential for erosion. Mitigation Measure Geology-4 does not allow surveys to be completed in quarries, and would prevent impacts to mineral resources. Some erosion may still occur, but the impacts would be less than adverse. Residual impacts would be less than significant and cease within one year of the termination of the proposed action.

#### **4.13.2 WATER RESOURCES**

The project could cause siltation or contamination of surface water due to loosened soil and accidental fuel leaks. Mitigation Measure Water Resources-3 would require that surveys be located at least 600 feet from standing water to avoid impacts from siltation. Mitigation Measures Water Resources-1 and -2 would respectively require that crew vehicles would be inspected to leaks prior to use and crews would be trained on recognizing vehicle leaks. Impacts would not be adverse. Should a spill occur, it would be small in scale, and would have no impact after one year. No residual impacts related to sedimentation or spills of hazardous materials are expected after implementation of mitigation measures.

#### **4.13.3 CULTURAL RESOURCES AND NATIVE AMERICAN CONCERNS**

The project would not result in the disturbance of any known or unknown archaeological or historic resources. Mitigation measure Cultural Resources-1 would require training of all crew members as to the cultural sensitivities of the project region and the requirements of all relevant agreements and regulations. Cultural Resources-2 requires work be ceased if human remains are encountered. Cultural Resources-3 requires a botanist to travel with the crew to ensure no ethnobotanical plants are impacted. Residual impacts to archaeological, historic, or human remains would not occur.

The project would have the potential for adverse impacts to Native American values and spiritual concerns. The stipulations of the MOA, as amended in 2005, would be implemented to avoid physical effects to elements of the environment identified to have traditional cultural values. Spiritual values could still be impacted. The mitigation and implementation of the MOA would minimize impacts to spirituality as much as is feasible; however, since the very presence of the surveys is thought to impact spirituality, residual impacts to spirituality may still occur during the surveys. These impacts would no longer occur after the survey is complete.

#### **4.13.4 BIOLOGICAL RESOURCES**

Impacts to special status plant species could occur as a result of implementation of the project. Impacts to general vegetative communities would be avoided by Mitigation Measure Biology-1, which would not allow the removal of large trees and shrubs. Mitigation Measure Biology -2 would require a biological monitor (botanist) to accompany survey crew members and facilitate avoidance or relocation of any species found. Impacts to special status animal species could occur as a result of implementation of the project.

The project has the potential to increase the spread of invasive species. Mitigation Measures Biology-3 and -4 would require that crew vehicles and exposed clothing be cleaned of plant matter before moving to another survey location.

Implementation of these measures would avoid impacts to special status plant and animal species, and the spread of invasive species. Residual impacts would be less than adverse and would cease after one year of the completion of the proposed project.



#### **4.13.5 VISUAL**

Impacts to scenic quality and visual resources would be limited to temporary alteration of foreground views. Mitigation Measure Visual-1 would not allow surveys to be completed in areas designated as Preservation under the USFS VQO system. With mitigation, there would be no adverse or residual impacts.

#### **4.13.6 LAND USE AND RECREATION**

Calpine proposed survey locations (as mapped from data provided by Calpine) that could be located on private land, land with special lease stipulations, campgrounds, or land with non-compatible land use designations. Mitigation Measures -1 through -4 would make the project consistent with various land use and recreation designations and requirements. With mitigation, there would be no adverse impacts.

With mitigation, there would be no impact to land use and recreation, and no residual impacts would occur.

#### **4.13.7 TRANSPORTATION AND TRAFFIC**

Impacts to traffic and transportation would be less than significant. Mitigation Measure Transportation-1 would prohibit Calpine survey crew vehicles from blocking an entire roadway when parked during on-foot survey activities. With mitigation, there would be no adverse impacts.

There would be no residual impacts when the project operations are complete.

#### **4.13.8 AIR QUALITY**

The project has the potential to increase PM<sub>10</sub> emissions from fugitive dust generated by vehicles traveling along unpaved roads and through off-road areas. Mitigation Measure Air Quality-1 would limit the allowable speed limit to 15 mph on access roads. The mitigation measure would be effective in reducing impacts. Dust may be generated with implementation of mitigation; the PM<sub>10</sub> would not affect local air quality. The project would generate some combustion emissions, associated with crew vehicles. With mitigation, there would be no adverse impacts.

Residual impacts would be less than adverse and cease when the project operations are complete.

#### **4.13.9 HUMAN HEALTH AND SAFETY/HAZARDS**

The project involves travel through rocky terrain, and work in a forested area. There are inherent risks involved with the survey activities to the crews and public. Mitigation Measure Hazards-1 would require that crews be trained in how to respond to serious injuries and emergencies. Hazards-2 requires that surveys do not occur during the two weeks of deer hunting season in October. The project could cause an increased risk of fire. Mitigation Measures Hazards-2 would reduce the risk of fire by allowing smoking only in certain areas. The impacts would not be adverse and there would be

There would be no residual impacts. Impacts would cease when the project operations are complete.

### **4.14 Cumulative Impacts**

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#### **4.14.1 INTRODUCTION**

NEPA requires that agencies consider the cumulative impacts of a proposed action or project. NEPA regulations define a cumulative effect as the effect on the environment that results from the incremental effect of the action when added to the effects of other past, present, and reasonably

foreseeable future actions, regardless of what agency or person undertakes the other actions and regardless of land ownership on which the other actions occur. An individual action when considered alone may not have a significant effect, but when its effects are considered in sum with the effects of other past, present, and reasonably foreseeable future actions, the effects may be adverse (40 CFR 1508.7 and 1508.8, and FSH 1909.15 Section 15.1).

This cumulative impact analysis considers impacts of the proposed action and other projects that have been proposed, or are reasonably foreseeable to take place in the vicinity of the proposed action. The primary activities considered in the analysis of cumulative impacts are other US Forest Service (USFS) projects in the vicinity that may occur at the same time as the proposed action.

The geographic area considered for cumulative impacts is generally considered to be a 5-mile radius from the proposed project area, although boundaries of analysis are dependent upon the type of impact to be assessed and the extent of the proposed project's impacts. The proposed project would take place in 2009.

The direct, indirect, and residual effects of the Proposed Action are described in above.

#### **4.14.2 PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTIONS**

The Modoc, Klamath, and Shasta-Trinity National Forests have several projects planned. Some projects pertain to all three Forests and some projects are specific to each Forest. Relevant projects are listed below by geographic extent.

#### **Geothermal Development Projects**

##### **Overview**

The effects of geothermal projects vary with the type of activity (exploration or development, well drilling or power plant operation). The effects of geophysical activities are described in this document. Further exploration and development are reasonably foreseeable actions that would occur as a result of the proposed action; however, it does not ensure that development would proceed. There are no pending geothermal-related activities that are expected to occur at the same time as the proposed action.

In general, effects of geothermal activities include vegetation clearing for well pads (approximately 3 acres per well pad), pipelines, access roads, and the power plant (6-10 acres). Power plants also require surface disturbance for the construction and operation of a transmission line. Construction activities create noise and dust; mitigation measures are applied to reduce effects. Well drilling creates noise, includes emissions of hydrogen sulfide in small amounts (controlled through application of Siskiyou County APCD rules and conditions), the drill rig is generally visible above the tree canopy, and creates a visible steam plume. Power plants contribute to background noise and emit a steam plume that is intermittently visible (plumes are most visible during cold, moist conditions). The surface disturbance and noise results in effects to biological resources; mitigation measures reduce the effects to less than significant levels for almost all parameters.

Additional exploration and development activities may have potentially significant effects on American Indians if the geothermal activities interfere with traditional practices in the nearby area. The effects of geothermal development in the forests are thoroughly described in the Final EIS/EIR for the Fourmile Hill Geothermal Development Project (1998), the Final EIS/EIR for the Telephone Flat Geothermal Development, and the MOA between the USFS, BLM, SHPO, and ACHP (as amended in 2005).

The impacts of the proposed project are limited to the timeframe for which the survey occurs. The proposed action leaves no lasting physical effects. If additional geothermal activities were to occur,

they would occur after completion of the proposed surveys and would therefore not have overlapping or compounding physical effects to any resources, such as air quality, traffic, biology, water quality, etc. The results of the proposed project would likely help in reducing future environmental impacts associated with well pad construction and drilling since the proposed project will help to better identify the location of the resource or the best locations to tap the resource. Any additional exploration would also require NEPA compliance and analysis as well. While the project may be followed by additional geothermal activities, those activities may also occur without the proposed action. Future geothermal development is addressed in this section only as it would overlap in physical impacts associated with the proposed action.

Other approved geothermal development is described below.

#### **1995 Calpine Fourmile Hill Exploration**

In 1995, Calpine Corporation proposed a geothermal exploration program within the Glass Mountain KGRA. Calpine Corporation proposed drilling two temperature gradient holes (TGH), 18-28 and 88-28, on Federal geothermal leases CA-21926 and CA-21924 in the Goosenest Ranger District, Klamath National Forest, Siskiyou County, California. These leases are located within the unit boundary of the KGRA, and are now committed to the geothermal unit. The project is referred to as the Calpine Fourmile Hill Exploration Program.

As the first phase of the project, Calpine completed drilling TGH 88-28 in the fall of 1994. The TGH well pad measures approximately 75 feet by 100 feet. In 2001, Calpine proposed deepening TGH 88-28. The proposal indicated Calpine would conduct a deep exploration drilling program at the site if the successful completion of TGH 88-28 confirms the presence of a heat source. Calpine deepened TGH 88-28 in 2001.

Calpine drilled a deep exploration well at site 88A-28 in 2002. This well was authorized under the 1995 EA/IS for the Fourmile Hill exploration project. The Siskiyou County APCD issued the permit for the well in 1999. Additional drilling has also occurred on existing pads.

#### **1995 CEGC Glass Mountain Unit/ Telephone Flat Geothermal Exploration Proposal**

CEGC, as the Glass Mountain Unit Operator, proposed a geothermal exploration program with multiple well pads. Calpine purchased CEGC and renamed the company CPN Telephone Flat, Inc. The effects of the project were addressed in a 1995 EA/IS. None of these exploration wells have been drilled as of October 2008. The activities authorized under this project are not expected to overlap with the proposed project.

#### **2002 Glass Mountain Exploration Wells**

Calpine proposed several activities in both the Fourmile Hill project area and in the Telephone Flat project area in 2002. Activities at Fourmile Hill included drilling an exploration well to 8,503 feet. The highest measured temperatures were about 450 degrees Fahrenheit, and the well flowed on its own during a 35-day flow test (CEC 2004). The planned drilling at Telephone Flat has not been started because of pending litigation.

#### **1995 Calpine Fourmile Hill Development**

In 1995, Calpine also proposed to initiate geothermal development on their Fourmile Hill leases. The Plan of Utilization addressed construction and operation of production and injection wells at five proposed pads, pipelines, a 49.9 MW power plant, and a 24-mile transmission line. Calpine committed to conducting exploration activities and confirming the presence and commercial viability of the geothermal resource prior to initiating activities related to power plant and transmission line construction. The EIS/EIR was completed in 1998 and the Record of Decision was issued in 1999.



The EIR was certified in 1998. Calpine has not initiated development activities as of September 2008. The EIS/EIR describes the effects of development.

### **1995 CEGC Telephone Flat Geothermal Development Proposal**

The CEGC proposed to construct and operate a 48 MW geothermal power plant, and associated production and injection wells, pipelines, and transmission line. The EIS/EIR was completed in 1999 and the Record of Decision was issued in 1999. The Record of Decision reflected the selection of the No Action alternative. The EIR was not certified. The No Action decision was since reconsidered by the BLM and USFS, and the project was approved. CPN, as the new owner of the project, requested that the Siskiyou County APCD consider certifying the EIR. The Siskiyou County APCD certified the EIR on February 14, 2003. None of the development activities have been initiated as the project is currently on hold for pending litigation between the tribes and the BLM.

## **Other Forest Projects**

### **Multiple-Forest Projects**

- **Geothermal Leasing:** The Programmatic EIS has been prepared for nationwide leasing of geothermal resources on high priority areas on BLM and Forest Service administered lands in order to expedite leasing. The Programmatic EIS only evaluates the impacts of leasing; it does not evaluate individual exploration and development projects. The Record of Decision for the Programmatic Leasing EIS is expected to be completed in February of 2009. The lease areas would then be subject to lease-specific environmental review (if leasing is not analyzed in detail) or the leases would be issued. Exploration is expected to commence after the leasing document is completed and the site-specific project environmental review is conducted. It is possible that some exploration activities on other leases may occur at the same time as the proposed project; however, there are no leases that directly overlap the proposed project area. The Medicine Lake/Glass Mountain area is listed as one of the High Potential Areas for geothermal development in Table 2-7 of the Draft Programmatic EIS (BLM 2008).
- **Designation of Energy Corridors on Federal Land:** The Programmatic EIS for nationwide designation of energy corridors evaluates potential impacts associated with designating energy corridors for oil, gas, and hydrocarbon pipelines, as well as electricity transmission and distribution activities (DOE et al. 2008). One of the designated corridors passes to the east of the project area, but not within 5 miles. Designation of energy corridors is expected in December 2008.
- **High Voltage Power Line Right-of-Way Vegetation Maintenance:** This project would authorize the Western Area Power Authority to control vegetation within its right-of-way across National Forest land. The right-of way for the 500-kV powerline passes approximately 2.5 miles southeast of the Calpine lease area. Approximately 20% of the power line right-of-way is treated every year; the potential for activities to occur simultaneously with the proposed project is low. Management activities would include cutting of trees that are leaning or infringing on the power line right-of-way, masticators to grind underbrush, and herbicide treatment to prevent regrowth. The management activities would be very low-impact, and would be comparable to typical USFS vegetation management activities (Smith pers. comm. 2008).

### **Modoc National Forest Projects**

- **Noxious Weed Treatment:** The Record of Decision for the Noxious Weed Treatment Final EIS was signed in August 2008. It allows for physical methods of noxious weed treatment, such as hand-pulling, hoeing, the use of hand-held string trimmers, and grazing by goats. Some herbicides may be used. Some noxious weed treatment would occur in the Calpine lease area. The noxious weed program would likely begin in January 2009 and would overlap the proposed project in area and timing of implementation.

- **Sagebrush Steppe Ecosystem Restoration Strategy:** A Record of Decision was issued on September 17, 2008 to implement this project, which would amend the Modoc LRMP. The amendment provides guidelines for achieving substantial restoration of the sage steppe ecosystem, which is dominated by big sagebrush, other shrubs, flowering plants, grasses, and forbs. Streams, springs, and seeps provide water to the sage steppe ecosystem. These ecosystems have become dominated by juniper in the Forest, and the project would help to restore the landscape to its natural setting.  
Mechanical treatments will be employed to reduce impacts to hazards (such as wildland fires), noxious weed spread, Native American cultural resources, and air quality. The project is expected to span a five-decade period of time, but no specific locations or timing of treatments has been specified. Site-specific treatments would require additional environmental analysis.
- **Hunting and Fishing Guides Proposed Special Use:** This project is an issuance of up to ten hunting and fishing guide authorizations on the Modoc National Forest for guides licensed by the State of California. This allows up to ten licenses to be issued in the coming year for hunting and fishing guides. Guides could take hunters into the proposed project area. The project was approved in May 2008. Only one license has been issued as of early October 2008 (Biggerstaff pers. comm, 2008).
- **Black Mountain Plantation Thinning and Fuels Treatment:** The project would involve thinning stands to include trees not exceeding a certain diameter. The project would also remove underbrush and burn residual fuels. This project would occur to the southeast of the Calpine lease area in the vicinity of Black Mountain. The thinning and treatment work is set to commence in November 2008.
- **Highlands Roadside Safety Improvement Project:** This project would improve public safety along major public travel routes by removal of hazard trees likely to fall onto the roadway. The project would also include removal of vegetation from various roads in the Medicine Lake Highlands in order to increase sight distance around corners. Methods used would include thinning, mowing, pruning, and burning. This project began in September 2008 and would continue throughout the time that the proposed project would be implemented.
- **Medicine Lake Highlands Road Closure:** This project will restrict Forest visitor vehicle travel to designated roads, providing greater protection to the natural resources, recreational use, and archaeological values of the area. The closed roads will not be decommissioned, and could be used for fire suppression and administrative duties; however, these roads can not be used by recreationalists or for geothermal-related activities. The Doublehead Ranger District issued a Finding of No Significant Impact and approved the road closures in March 2008.
- **Medicine Lake Interpretive Signing:** This project would include the installation of interpretive signs at various locations in the Medicine Lake Highlands. The signs would explain the origin and uniqueness of the area to visitors. Expected implementation is July 2009.
- **Verizon Equipment Shelter – Timber Mountain:** The USFS has issued a 10-year special use permit to install and maintain an equipment shelter near Timber Mountain, to the east of the Calpine lease area. The shelter would be about 12 by 20 by 10 feet in dimension and would accommodate updated technology for cellular service. The special use permit was granted in May 2008. The project does not overlap the Calpine lease and proposed geophysical survey area.
- **Pumice Mining Claim:** The USFS allows small-scale pumice mining in the Modoc National Forest under an NOI for a period of five years under a mining claim held by an individual. The mining operation consists of one person picking up pumice by hand from various areas on the Modoc National Forest (Biggerstaff pers. comm. 2008).

### **Klamath National Forest Projects**

- **Big Pony Project:** This project would occur about 5.5 miles to the west of the Calpine lease boundary. It would involve reducing stand densities to improve forest health and reduce fire hazards in research study areas. The project is not scheduled to commence until June 2011 and would therefore occur after the proposed project is completed.
- **Deer Mountain Trailhead Rehabilitation:** This project would involve leveling and resurfacing the gravel parking area and adjacent overflow parking area for the Deer Mountain Trailhead. The project area is to the west of the Calpine lease area and does not overlap survey areas. Implementation began in August 2008.
- **Hi-Grouse Project:** This project would involve restoring forest stands that have been adversely affected by fir encroachment, over density, insects, and disease. It would help to maintain habitat for species of local interest. A timber sale is included in the project and a Record of Decision is scheduled for release in 2010 (Barnum pers. comm. 2008). The project would occur on parcels on the far west side of the Calpine lease area, and on parcels immediately outside the west Calpine lease area boundary. Expected implementation is June 2010.
- **Mystery Project:** This project would involve forest thinning from below to improve forest health conditions. Treatments to enhance big game habitat, such as forest thinning from below to enhance forest health, would also be done. This project would occur in various locations just outside the western boundary of the Calpine lease area. Expected implementation is June 2010.

### **Shasta-Trinity National Forest**

- **Waterlines for Nestle Bottling Plant:** An EA is being prepared for the construction of waterlines proposed from Intake and Elk Springs. The waterline would support a proposed water bottling plant in McCloud, California, approximately 23.5 miles southwest of the Calpine lease area boundary. This project is currently on hold.

## **4.14.3 CUMULATIVE IMPACTS OF THE PROPOSED PROJECT**

### **Overview**

The cumulative impacts of the relevant projects in conjunction with the proposed project are described below. Measures are proposed as conditions of the project and would reduce all impacts to less than significant levels.

### **Proposed Action**

#### **Geology, Soils, and Seismicity**

The proposed project would involve minimal disturbance of soils, leading to a small potential for erosion. Cumulative impacts would occur if other projects involved significant amounts of ground disturbance that could, in conjunction with the proposed project, lead to severe erosion and cause siltation of a waterway or water body, or lead to slope instability. Erosion would not be a significant concern in this area as there is minimal surface water runoff due to the high permeability of surface soils. Significant wind erosion would not be expected to occur in the forested areas.

Mitigation for the proposed project would require that surveys be located at a minimum distance from bodies of water (600 feet) to prevent erosion and siltation. All disturbed areas would be reclaimed to prevent future erosion at the project site.

Some of the other projects would involve ground disturbance and vegetation removal and could lead to erosion and slope instability depending on where the project takes place. Mitigation would likely



be outlined for other projects in order to prevent erosion. The potential impacts of erosion are so small for the proposed project that the proposed project would not have cumulative impacts on geology and soils.

The project would not cumulatively impact mineral resources because the project would have no impact on mineral resources.

#### **Water Resources and Water Quality**

The proposed project would present a risk to degrade water quality because of the potential for siltation and accidental fuel leaks from crew vehicles. The proposed project would not utilize surface water. Cumulative impacts would occur if the project, in conjunction with another project, would seriously degrade water quality due to a hazardous materials spill or other means of contamination. Mitigation measures would reduce the risk of siltation and fuel leaks to less-than-significant levels. The potential for a hazardous materials spill being compounded by any of the other projects in the area is low.

Some of the other projects would involve ground disturbance and use of fuels and could lead to degradation of water quality. Vegetation management projects that require the removal of some vegetation could loosen soil and lead to siltation. Mitigation would likely be outlined for other projects to prevent these impacts. The proposed project would not have cumulative impacts on water resources.

The project would not cumulatively impact groundwater use or quality because the project would have no impact on groundwater use or quality.

#### **Cultural Resources and Native American Values**

The proposed project would not have adverse impacts to prehistoric or historic resources. The project would be implemented to avoid all resources. Therefore, the project would not have any considerable cumulative effects with other projects being conducted in the area.

The proposed project would have the potential to have an adverse impact on the spiritual qualities of the area as described by the tribes. The activities would be conducted in accordance with the stipulations of the MOA (USFS et al, 2005 as amended) and the interim guidelines for addressing cultural values in the Medicine Lake Highlands (Appendix D). Future geothermal activities may occur with or without the proposed project and those activities would have an adverse impact on spiritual values as well. The proposed project; however, does not aggregate with those impacts. The proposed project would actually help reduce the amount of clearing for construction of pads and drilling that may occur without the project. The proposed project has lesser effects on spiritual values than constructing pads, using drill rigs, etc. because the proposed surveys are temporary, barely visible, inaudible, and require little ground disturbance. The proposed project would likely lessen the impacts of future exploration and development, were it to occur.

Other activities in the forest may also impact the spiritual values of the Highlands; however, given the minimal disturbance associated with the proposed project and the temporary nature of the project (i.e., individual locations for surveys would be impacted for less than 1 day, each), adverse impacts from the proposed project are not compounded by other proposed actions in the forests. All actions in the forest must consider and incorporate the recommendations of the Medicine Lake Highlands HRMP to help minimize effects to Native American Values and to prevent impacts to the property as determined eligible for the NRHP.

#### **Biological Resources**

The proposed project has the potential to impact special status species, general vegetative communities, and wildlife. Mitigation measures are designed to avoid adverse effects. Cumulative

impacts would occur if the project, in relation to another project, led to a substantial spread of invasive species or threatened the existence of a special status species or its habitat. Some proposed projects listed above would involve the removal of noxious weeds. Ongoing projects also involve the removal of noxious weeds, and Categorical Exclusions are prepared as necessary for hand pulling of weeds (Posey pers. comm. 2008). The proposed project would disturb small areas, and with implementation of mitigation measures such as sensitive plant surveys and avoiding the removal of vegetation would have less than significant impacts to sensitive species and the spread of invasive plants.

Some of the other projects would involve disturbance of wildlife habitat, and the vegetation management projects would involve removal of vegetation. Any project involving travel across USFS land could lead to the spread of invasive species. Measures would likely be defined for the other projects to reduce potential impacts. The project would not have a significant contribution to cumulative impacts to biological resources.

### **Visual Resources**

The proposed project would have temporary impacts on visual resources during the surveys; however, the impact would occur in foreground views and would not impact the more scenic background views. Cumulative impacts would occur if the project, in relation to another project, led to a substantial alteration of scenic vistas or a substantial degradation of the scenic value of the area. The other projects, such as the vegetation management projects, could slightly alter the foreground, but likely would not alter the scenic quality of the area. Measures would likely be defined for other projects to reduce potential impacts to visual resources.

The proposed project would have temporary impacts to visual quality through the presence of workers and trucks. With implementation of mitigation measures to minimize impacts and prevent the alteration of the scenic value of the area, the project would not contribute to cumulative impacts to visual resources.

### **Land Use and Recreation**

The geophysical surveys are short-term and temporary and are not expected to result in a cumulatively significant impact on existing land uses such as recreation, timber harvesting, and other land uses in the area. The proposed project would not represent new land use in the area since other geothermal projects have been and continue to be underway. Geothermal development is provided for by the geothermal leases administered by BLM in the area, and it is consistent with existing Klamath and Modoc National Forest Plans and Siskiyou and Modoc County General Plans. With the implementation of project specific mitigation measures, the identified projects are not expected to result in a significant cumulative impact on existing land uses.

Geophysical survey work in the area would result in short-term and temporary impacts which may affect dispersed recreation in the area, but these impacts are not expected to be significant. Mitigation outlined for the proposed project would not allow surveys to occur during deer hunting season. The identified geothermal development and timber projects would not be located in the immediate proximity of developed recreation sites. Other projects may impact recreation; however, the proposed project would not likely contribute to an overall adverse impact. With the implementation of project-specific mitigation measures, the identified projects are not expected to result in a significant cumulative impact on recreation.

### **Traffic and Transportation**

The proposed project would have less-than-significant impacts on transportation and traffic. The impact would be less than significant with implementation of mitigation. Cumulative impacts to transportation and traffic would occur if the project, in relation to another project, led to a substantial

increase in traffic volume or an exceedence of a level of service of a roadway. The other projects would likely not be associated with a high volume of traffic. Measures would likely be defined for other projects to reduce potential impacts.

The proposed project would have temporary impacts to traffic and transportation. With mitigation, there would be no contribution to cumulative impacts to transportation and traffic.

#### **Air Quality**

The proposed project would have some emissions during construction, including particulate matter and emissions from combustion of fossil fuels. The region is designated attainment for particulate matter and the proposed project would generate some particulate matter. Cumulative impacts could occur if projects occurring simultaneously also produced enough particulate matter to exceed ambient air quality standards. Any of the projects that would involve travel on unpaved roads would contribute to the generation of fugitive dust; however, most of these projects would not likely involve a substantial generation of particulate matter and it is likely that measures would be enforced to reduce fugitive dust levels. The impacts would also be temporary. Fugitive dust would also be controlled for the proposed project.

The proposed project would not generate significant air emissions during operation, and would not contribute to cumulative impacts to air quality.

#### **Noise**

Noise would be minimal as survey equipment does not generate any noise. The greatest source of noise in remote areas would be from crew member communications. The most sensitive receptors would be Native Americans visiting the Highlands for traditional practices. Mitigation including minimizing noise as much as possible and using walky-talkies instead of shouting would reduce impacts. Other projects may also generate noise in proximity to the proposed surveys; however, cumulative effects would not be compounded because the proposed project would occur for such short periods of time in each location. Set-up usually takes about 1 hour and take down takes about 1 hour. This temporary period of human presence may compound with other project noise; however, it would be of a short enough duration to not be considered cumulatively adverse.

#### **Human Health and Safety/Hazards**

The proposed project would pose a minor risk to workers and the public from survey equipment left on site, accidents, and an increased risk of wildfires. Cumulative impacts would occur if the projects occurring simultaneously would substantially increase the risks to human health and safety or the risk of wildland fire. The impacts of the proposed project would be less than significant with mitigation. Any of the proposed projects could increase the risks to human health and safety and the risk of wildland fire by introducing people to forested areas. Mitigation would likely be outlined for the other projects.

With mitigation that requires adherence to fire safety protocol and safety warnings on survey equipment, the increase in risks associated with human health and safety would be less than significant. There would be no contribution to cumulative impacts to human health and safety.

#### **Socioeconomics and Environmental Justice**

The proposed surveys would be located entirely within the Klamath, Modoc, and Shasta-Trinity National Forests. Some of the surveys are located within the Medicine Lake Highlands Historic Properties Management District. Cumulative impacts to environmental justice would occur if the proposed project, in concurrence with other projects, resulted in disproportionate impacts to minority groups. The proposed project would disproportionately impact Native American groups. If other



projects would also have disproportionate impacts to Native American groups, which would be identified in consultation, then the project would contribute to cumulative impacts to environmental justice.

The proposed project would have no impact on socioeconomics. Therefore, it would not contribute to cumulative impacts to socioeconomics.

### **No Action Alternative**

Under the No Action Alternative, Calpine would not perform the geophysical surveys. There would be no cumulative impacts as a result of the project; however, greater cumulative impacts could occur if further exploration was to occur and more exploration wells were needed to better determine the location of the geothermal resource.

### **4.14.4 MONITORING**

Calpine (the applicant) would appoint a field manager to self-monitor project operations for compliance with the terms of the EA and any permit conditions. The field manager would be familiar with the environmental compliance, and would prepare weekly monitoring compliance reports to submit to the BLM. The BLM-Alturas Field Office may also conduct a compliance inspection to monitor environmental concerns and adherence to mitigation.



# 5: LIST OF PREPARERS AND AGENCIES/PERSONS CONTACTED

## 5.1 Lead and Cooperating Agencies

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This section lists those individuals who either prepared or participated in the preparation of this EA. The BLM is serving as the NEPA lead agency for preparation of this EA. The United States Department of Agriculture, Forest Service is serving as a NEPA cooperating agency. The following individuals were involved in preparation of the document.

### US Department of the Interior, Bureau of Land Management

Tim Burke	<i>Alturas Field Office Manager</i>
Sean Haggerty	<i>Geothermal Program Lead, Sacramento, California</i>

### US Department of Agriculture, Forest Service

Lawrence Crabtree	<i>District Ranger, Doublehead Ranger District</i>
Amy Gowan	<i>Designated Federal Official, Resource Advisory Committee</i>

## 5.2 Consultant Team

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This EA was prepared for and under direction of the BLM by RMT, Inc. RMT is located in San Mateo, California. The following staff contributed to this report:

### RMT, INC.

Preparer	Position	Expertise/Sections Prepared
Laurie McClenahan Hietter	Project Director	Quality Control/Quality Assurance
Tania Treis	Project Manager	Project Management; Introduction; Project Description; Cultural Resources and Native



## 5: LIST OF PREPARERS AND AGENCIES/PERSONS CONTACTED

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		American Concerns; Biological Resources; Air Quality; Socioeconomics and Environmental Justice
Kristi Black	Environmental Analyst	Geology, Soils, and Seismicity; Water Resources and Water Quality; Visual Resources; Land Use and Recreation; Traffic and Transportation; Noise; Human Health and Safety and Hazardous Materials; Cumulative Impacts
Corey Fong	Cartographer	GIS and mapping
Roger Luc	Document Manager	Document Production
Dr. Dorothea Theodoratus	Anthropologist	Ethnography
Kathleen McBride	Anthropologist	Ethnography

### 5.3 Agencies/Persons Contacted

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The following agencies and persons were contacted during the preparation of this document:

#### **California Department of Fish and Game**

Pete Figura                      *Wildlife Biologist*

#### **California Department of Transportation**

Scott White                      *Chief, Office of System Planning*

#### **Siskiyou County, Department of Agriculture, Air Pollution Control District**

Scott Dunn                      *Air Pollution Specialist*  
Carolyn Gordon                *Deputy Agricultural Commissioner*

#### **U.S. Bureau of Land Management**

Tim Burke                      *Alturas Field Manager*  
Claude Singleton               *Recreation Planner*

#### **U.S. Department of Agriculture, Forest Service, Fremont-Winema National Forests**

Amy Gowan                      *Designated Federal Official, Resource Advisory Committee*

#### **U.S. Department of Agriculture, Forest Service, Klamath National Forest**

Emelia Barnum                *Environmental Coordinator*  
Jan Ford                        *Public Use and Recreation Staff Officer*  
Jerry Mosier                    *Landscape Architect*  
Susan R. Stresser              *Wildlife Biologist*  
James Stout                    *Resource Officer*

#### **U.S. Department of Agriculture, Forest Service, Modoc National Forest**

Jayne Biggerstaff              *Lands and Minerals Specialist*  
Lawrence Crabtree             *District Ranger, Doublehead Ranger District*

Forest Jay Gauna	<i>Assistant Forest Botanist</i>
Robert Haggard	<i>Public Services Staff Officer</i>
Bill Schoeppach	<i>Vegetation Specialist</i>
Marty Yamagiwa	<i>Wildlife and Fisheries Program Manager</i>

**U.S. Department of Agriculture, Forest Service, Shasta-Trinity National Forest**

Susan Erwin	<i>Westside Botanist</i>
Dennis Poehlmann	<i>Forester and Team Leader, Mt. Shasta Ranger District</i>
Rhonda Posey	<i>Botanist</i>
Stacy Smith	<i>Special Use Officer</i>

**U.S. Department of Agriculture, Forest Service, Remote Sensing Lab**

Dan Studer	<i>Natural Resource Information Analyst - GIS</i>
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**Native American/American Indian Tribes**

Pit River Tribal Council  
Klamath Tribe

5: LIST OF PREPARERS AND AGENCIES/PERSONS CONTACTED

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# **APPENDIX A: SCOPING DOCUMENTS**





# United States Department of the Interior



## BUREAU OF LAND MANAGEMENT

Alturas Field Office  
708 W. 12<sup>th</sup> Street  
Alturas, CA 96101  
[www.ca.blm.gov/alturas](http://www.ca.blm.gov/alturas)

In reply refer to:  
3200 (CA-320)P  
NOI-320-08-02

June 12, 2008

Dear Interested Party:

The purpose of this letter is to notify you that the Bureau of Land Management (BLM) has received an application from Calpine Corporation to conduct geophysical surveys on BLM-issued leases in the Glass Mountain Known Geothermal Resources Area (KGRA) (Figure 1).

The proposed surveys would be located entirely on United States Forest Service land leased to Calpine for geothermal activities in the Glass Mountain KGRA. Calpine is proposing to conduct Magnetotelluric (MT) and time-domain electromagnetic method (TDEM) geophysical surveys in late 2008 to early 2009.

As Lead Agency under the National Environmental Policy Act (NEPA), the BLM is requesting comments on the scope of an Environmental Assessment (EA) for the proposed project, described below.

### Project Description

Calpine Corporation proposes to conduct the Glass Mountain Area Geophysical Survey project. The project would include collecting data from 120 MT and TDEM stations on federal land within the Glass Mountain KGRA, as shown in Figure 2. The time period in which the survey would be completed would span five to eight weeks and would likely occur in late 2008 or early 2009. Calpine's Notice of Intent is attached to this letter. The purpose of this survey is to gather additional geophysical data between points that were previously surveyed in 2005.

The methods and contractor utilized in 2005 for similar surveys would also be used for the proposed surveys. The survey methods would not require the use of any mechanical construction equipment and would not require construction of new roads. A trained archaeological monitor is proposed to travel with the survey team and would relocate any points as needed to avoid sensitive resources.

*MT Survey Description.* The MT survey requires the use of geographic positioning systems (GPS) to locate and travel to survey sites identified in Figure 1. To install the MT, a worker would bury two magnetometers in a groove measuring six inches deep and four feet long that would be dug with a shovel. A third magnetometer would be installed vertically in a 24-inch post hole, also dug by hand. Five electrodes would be buried in separate six-inch diameter holes

containing water or wet clay. Wires 150 feet in length would be connected to the electrodes and laid on the ground. A shoe-box sized recorder would be connected to the electrodes and magnetometers. The recorder would be left overnight to record electromagnetic signals, which are given off by the sun and regional thunderstorms. The next morning, the equipment would be removed the area reclaimed to previous conditions.

*TDEM Survey Description.* A crew member would travel by foot to lay wire on the ground, forming a wire loop 300 feet across. A transmitter-recorder that is the size of a briefcase would be connected to the wire. The transmitter-recorder would send a pulse of current into the wire and record a signal. The TDEM survey process would take less than an hour, during which time the MT equipment would be installed or removed from the same survey site.

### **Project Location**

The proposed project area is located within the Glass Mountain KGRA. The KGRA is located in the Medicine Lake Highlands of the Modoc, Klamath, and Shasta-Trinity National Forest, about 30 miles northeast of Mount Shasta. The proposed survey would take place on lands between the station locations used in 2005, as shown in Attachment 2.

### **Probable Environmental Effects/Issues Scoped for the Environmental Assessment (EA)**

The EA will describe all potential impacts on the environment caused by the project and will identify possible mitigation measures to reduce or eliminate those impacts. The EA will describe the potentially affected environment and the impacts that may result to:

- Meteorology/ Air Quality
- Geology/Soils
- Mineral Resources (including geothermal)
- Biological Resources
- Water Resources
- Cultural Resources and Native American Concerns
- Land Use
- Noise
- Infrastructure
- Aesthetics
- Socioeconomics (including Mineral Rights)
- Traffic and Transportation

## Development of Alternatives

NEPA requires that a reasonable range of alternatives to the proposed action be considered during environmental review. The definition of alternatives is governed by the "rule of reason." An EA must consider a reasonable range of options that could accomplish the agency's purpose and need and reduce environmental effects. Reasonable alternatives are those that may be feasibly carried out based on environmental, technical, and economic factors.

The need for project redesign, or a project alternative, will be determined during the course of environmental review. The No Action alternative will also be addressed.

## Public Scoping

This letter has been sent to interested parties to supply input on issues to be discussed in the EA. Agencies should identify the issues, within their statutory responsibilities, that should be considered in the EA. The general public is also invited to submit comments on the scope of the EA on or before Friday, July 18<sup>th</sup>, 2008. Please send your comments regarding the scope and content of the EA, along with the name and address of an appropriate contact person to:

Field Manager  
Alturas Field Office  
708 West 12<sup>th</sup> Street  
Alturas, CA 96101  
[tburke@ca.blm.gov](mailto:tburke@ca.blm.gov)

Thank you for your participation in the environmental review process.

Sincerely,



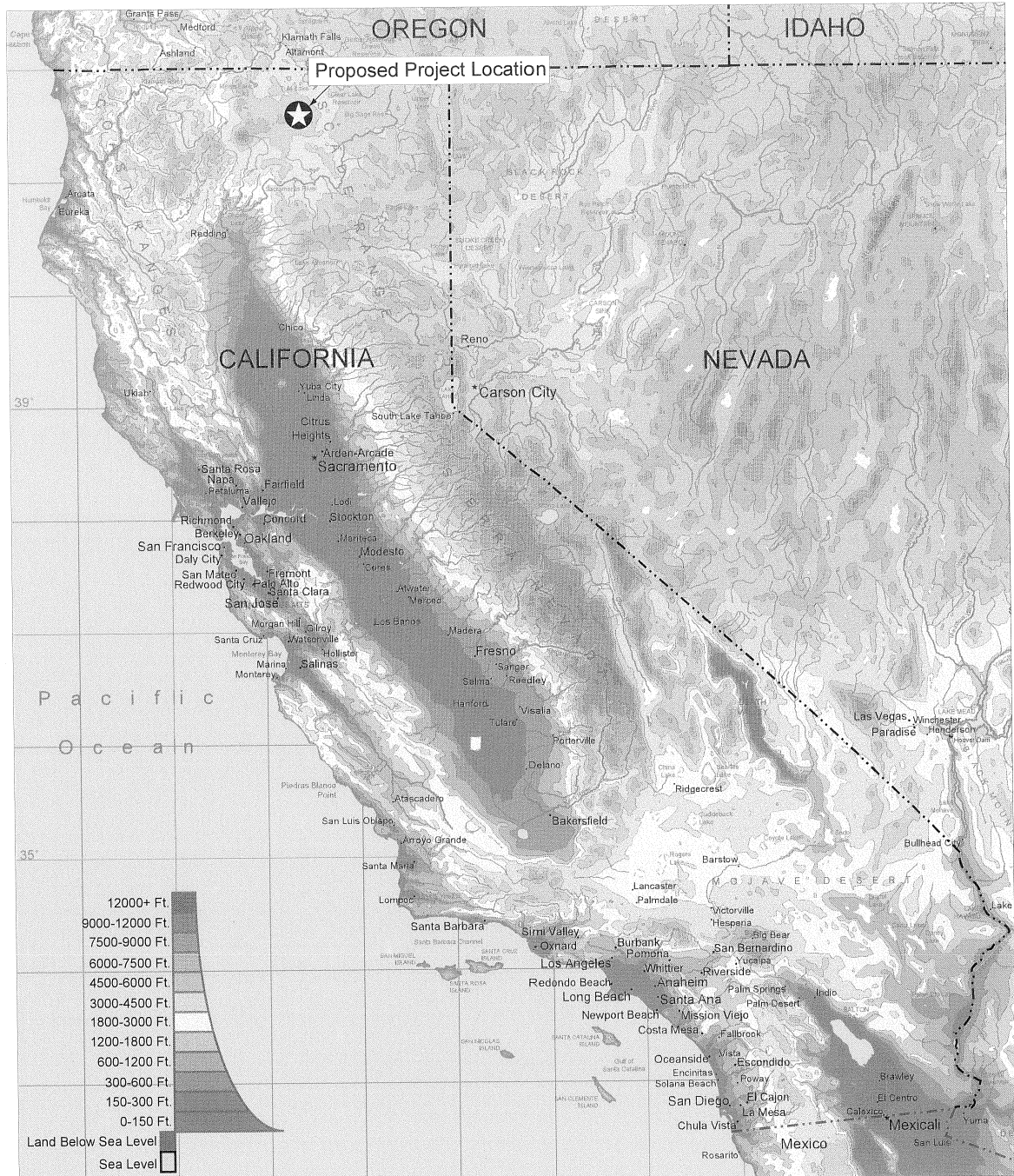
Timothy J. Burke  
Field Manager

## Enclosures

cc:  
S. Hagerty (CA-920)  
L. Crabtree  
L. Allen  
S. Heywood



**Figure 1: Proposed Project Location**



SOURCE: Cartesia 1998 and MHA Environmental Consulting 2008

**LEGEND**

★ Proposed Project Location

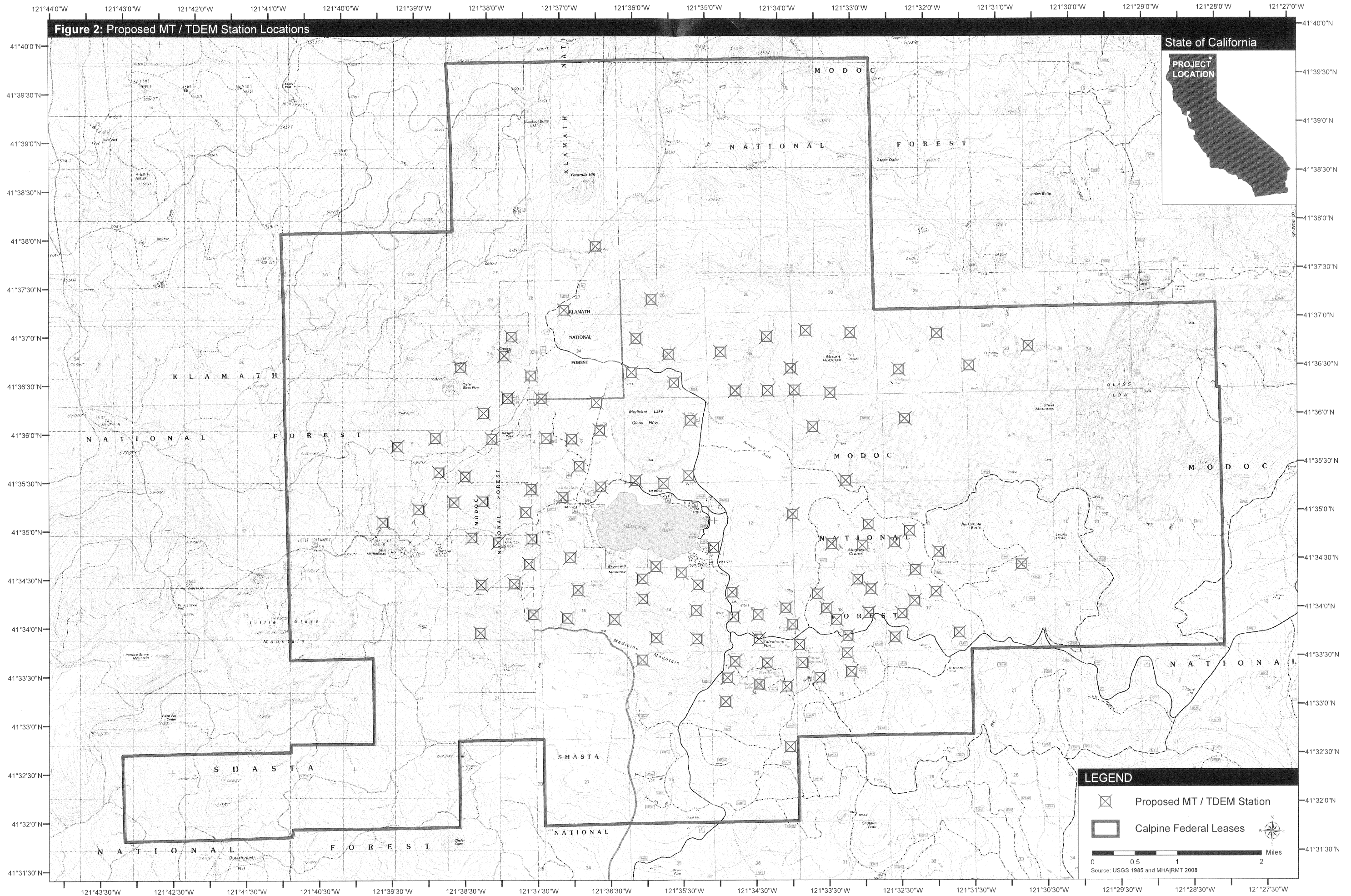


0 100 200 Miles at 39° N 0° E Parallel

0 100 200 Miles at 35° N 0° E Parallel

**RMT** | **MHA**  
Environmental Consulting

Figure 2: Proposed MT / TDEM Station Locations







GM-08-002

March 4, 2008

Mr. Tim Burke,  
Area manager, Alturas Resource Area Office  
Bureau of Land Management  
708 West 8<sup>th</sup> Street  
Alturas, CA 96101

Mr. Laurence Crabtree  
Doublehead District Ranger  
Modoc National Forest  
800 West 8<sup>th</sup> Street  
Alturas, CA 96101

Subject: NOTICE OF INTENT TO CONDUCT GEOTHERMAL RESOURCE  
EXPLORATION OPERATIONS

Dear Mr. Burke and Mr. Crabtree:

Calpine Corporation for and behalf of CPN Telephone Flat Inc. and Calpine Siskiyou Geothermal Partners, L.P. intends to continue exploration of the Glass Mountain geothermal resource by conducting further geophysical surveys of prospective areas in 2008. The surveys to be conducted will be a continuation of the Magnetotelluric (MT) and Time-Domain Electromagnetic Method (TDEM) previously successfully employed in 2005. The methodology and contractor will be the same as the 2005 surveys.

The 2005 surveys were successfully conducted with negligible environmental and cultural impact and these future operations will proceed in the same fashion. A tribal cultural monitor will be employed continuously to facilitate the location of survey stations away from any cultural resources. In 2005 only two of 91 survey station locations required any modification and these changes were easily and successful implemented.

For your assistance a full description of the proposed methodology is attached together with a map and a table of the survey station locations. Only stations within the leases are proposed.

Public benefits accrue from this survey as it will better refine the location and extent of geophysical anomalies and reduce the number and extent of exploration wells needed to locate the resource. This will accelerate the development of the resource meeting the Federal Government's goals and California's desired objective of obtaining 20% renewable power generation by 2013.

We look forward to your early approval of this survey. Should you require any further information please contact the undersigned.

Sincerely,

Andrew J Whittome  
Director, Project Development  
Calpine Corporation  
(925) 479-6777

CALPINE CORPORATION

3875 Hopyard Road, Suite 345 • Post Office Box 11749 • Pleasanton, CA 94588

Phone: (925) 479-6600 • Fax: (925) 479-7300



Attachments: Form 3200-9 Notice of Intent to Conduct Geothermal Resource Exploration  
Operations  
Project Plan details  
Map of Project Area with geophysical stations  
List of station coordinates

Cc: S Hagerty  
B Carlson  
M Stark  
R Thomas

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT

FORM APPROVED  
OMB No. 1004-0132  
Expires: July 31, 2010

NOTICE OF INTENT TO CONDUCT GEOTHERMAL RESOURCE  
EXPLORATION OPERATIONS

Applicant(s) <i>CALPINE CORPORATION for CPN Telephone Flat INC. Calpine Siskiyou Geothermal Partners, L.P.</i>	Address (include zip code) <i>3875 Hayward Rd. Suite 345 Pleasanton CA 94588</i>
Operator (name and telephone number) include area code <i>ANDREW WHITMAN 925-479-6777 office, 925-321-4957 mobile</i>	Address (include zip code) <i>3875 Hayward Rd. Suite 345 Pleasanton CA 94588</i>
Contractor(s) <i>GEOSYSTEM USA INC.</i>	Address (include zip code) <i>PMB # 643 2261 Market St. San Francisco, CA 94114-1600</i>

hereby apply for authorization to conduct exploration operations pursuant to the provisions of 43 CFR 3250 now or hereafter in force across and upon the following-described lands (give description of lands by township, attach map or maps showing lands to be entered or affected).

*T43N, T44N R3E, R4E see attached map*

Type of operations to be conducted (give brief description).

*Magneto-telluric (MT) and Time Domain Electromagnetic Method (TDEM) Geophysical Survey - see description*

Exploration operations will be conducted during the period (date) from *MAY 2008* to *NOVEMBER 2008*

Attached  \$ *150,000 existing* Surety bond  Rider to Nationwide bond  Rider to Statewide bond  Bond to be furnished

Upon completion of exploration operations, the undersigned agrees to notify the Bureau of Land Management (BLM) that authorized exploration operations have been completed in conformance with the general and special terms and stipulations of the notice.

The undersigned hereby agrees (1) that he will not enter upon the described land until he has been informed in writing whether there are special stipulations applicable to his Notice of Intent, as to either time or method of operation or otherwise, and if there are such stipulations, what those stipulations are, (2) that he will comply with those special stipulations, if any; and (3) that he will not enter upon the described lands until his entry has been approved by the BLM.

The undersigned agrees to be bound by the terms and conditions of this notice to conduct exploration operations when approved by the BLM.

The undersigned agrees that the filing of this Notice under the regulations (43 CFR Subpart 3250) does not vest or confer any preference right to a geothermal resources lease.

The undersigned agrees further that all exploration operations must be conducted pursuant to the following terms and conditions:



1. Exploration operations must be conducted in compliance with all Federal, State, and local laws, ordinances, or regulations which are applicable to the area of operations including, but not limited to, those pertaining to fire, sanitation, conservation, water pollution, fish, and game. All operations hereunder must be conducted in a prudent manner.
2. Due care must be exercised in protecting the described lands from damage. All necessary precautions must be taken to avoid any damage other than normal wear and tear to improvements on the land including, but not limited to, gates, bridges, roads, culverts, cattle guards, fences, dams, dikes, vegetative cover, improvements, stock watering, and other facilities.
3. All drill holes must be capped when not in use and appropriate procedures must be taken to protect against hazards in order to protect the lives, safety, or property of other persons or of wildlife and livestock.

4. All vehicles must be operated at a reasonable rate of speed and, in the operation of vehicles, due care must be taken to safeguard livestock and wildlife in the vicinity of operations. Existing roads and trails must be used wherever possible. If new roads and trails are to be constructed, the BLM must be consulted prior to construction as to location and specifications. Reclamation and/or seeding of new roads and trails must be made as requested by the BLM.
5. Upon expiration, conclusion, or abandonment of operations conducted pursuant to this Notice, all equipment must be removed from the land, and the land must be restored as nearly as practicable to its original condition by such measures as the BLM may specify. All geophysical holes shall be safely plugged. The BLM must be furnished a Notice of Completion of Geothermal Resource Exploration Operations (Form 3200-10) immediately upon cessation of all such operations and must be further informed of the completion of reclamation work as soon as possible.
6. Location and depth of water sands encountered must be disclosed to the BLM.

7. Operator must contact the BLM prior to actual entry upon the land in order to be appraised of practices which must be followed or avoided in the conduct of exploration operations pursuant to the terms of this *Notice* and applicable regulations. Operator will conduct no operations on the land unless the attached bond is in good standing.
8. Due care must be exercised to avoid scarring or removal of ground vegetative cover.
9. All operations must be conducted in such a manner to avoid (a) blockage of any drainage systems; (b) changing the character, or causing the pollution or siltation of rivers, streams, lakes, ponds, waterholes, seeps and marshes; and (c) damaging fish and wildlife resources or habitat. Cuts or fills causing any of the above-mentioned problems will be repaired immediately in accordance with specification of the BLM.
10. Vegetation must not be disturbed within 300 feet of waters designated by the BLM, except at approved stream crossings.
11. Surface damage which induces soil movement and/or water pollution must be subject to corrective action as required by the BLM.
12. Trails and campsites must be kept clean. All garbage and foreign debris must be eliminated as required by the BLM.
13. Operator must protect all survey monuments, witness corners, reference monuments, and bearing trees against destruction, obliteration, or damage. He must, at his expense, reestablish damaged, destroyed, or obliterated monuments and corners, using a licensed surveyor, in accordance with Federal survey procedures. A record of the reestablishment must be submitted to the BLM.

14. Operator must make every reasonable effort to prevent, control, or suppress any fires started by the operator, and to report, as soon as possible, to the BLM location and size of fires, and assistance needed to suppress such fires. Operator must inform the BLM as soon as possible of all fires, regardless of location, noted, or suppressed by independent action.
15. No work must be done within one-half mile of a developed recreation site without specific written authority from the BLM. Any travel within one-half mile of a recreation site must be over existing roads or trails.
16. Use of explosives within one-half mile of designated waters is prohibited unless approved, in writing, by the BLM.
17. If operations conducted under the provisions of this *Notice* causes any damage to the surface of the national resource lands, such as, but not limited to, soil erosion, pollution of water, injury or destruction of livestock or wildlife, or littering, operator must, within 48 hours, file with the BLM a map showing exact location of such damage and a written report containing operator's plans for correcting or minimizing damage, if possible.
18. Violation of, or failure to comply with any of these terms and conditions will result in immediate shutdown of field operations until deficiency is corrected. Failure to correct deficiency within the time period allowed by the BLM will result in forfeiture of bond.
19. The Bureau of Land Management reserves the right to close any area to operators in periods of fire danger or when irreparable damage to natural resources is imminent.
20. Contractor will be liable for assuring compliance with all terms and conditions of this *Notice* and all sections of his designated operator, agents, and employees.
21. Where continuation of the operation will result in irreparable damage to the land and other natural resources this *Notice* will be immediately canceled by the BLM.

22. Special Stipulations:

	3-5-2008		3-5-2008
(Signature of Applicant)	(Date)	(Signature of Operator)	(Date)

We hereby agree to the special stipulations added and made a part of this *Notice* to conduct exploration operations.

(Signature of Holder of Notice)	(Date)	(Signature of Operator)	(Date)

I hereby approve this *Notice* to conduct exploration operations.

(Signature of BLM)	(Title)

Title 18 U.S.C. Section 1001, makes it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious, or fraudulent statements or representations as to any matter within its jurisdiction.



## **MT and TDEM survey at Glass Mountain KGRA**

### ***Project plan***

This survey proposal involves collecting 120 magnetotelluric (MT) stations on federal land within the Glass Mountain Known Geothermal Resource Area (KGRA). Time domain electromagnetic (TDEM) stations would be collected at the same time and location. The survey would be completed over a five to eight week period between May and November 2008. One week would be required for scouting and preliminary review of the sites. Access would be either by vehicle on existing roads or on foot.

A similar survey including 91 MT-TDEM stations was conducted in October 2005 covering a similar area. The results of the 2005 survey were used to design the proposed station layout, filling in gaps between stations that proved to be conceptually important. The surface impact of the MT and TDEM surveys in 2005 was insignificant. Two to four MT crews with one vehicle each traveled separately and left no physical impact. Each crew consisted of one expert operator and one or two laborers who were mostly members of local Indian tribes subcontracted through an environmental company.

The installation of an MT station involves using GPS to travel to a previously scouted site by vehicle on existing roads or by foot where off road. Two magnetometers are buried in six inch deep, four foot long grooves in the soil to avoid wind vibration. A third magnetometer is set vertically in a 24" post hole. Small holes six inches across are dug and water and perhaps wet clay are added before burying five electrodes connected to 150 foot long wires laid along the ground. The electrodes and magnetometers are connected to a recorder the size of a shoe box and left overnight to record natural electromagnetic signals from the sun and distant thunderstorms. The equipment is picked up the following morning and moved to the next site.

The impact of a TDEM station is about the same as the impact of walking to the site. A person walks in a square while laying wire on the ground to make a loop 300 feet across. A briefcase-sized transmitter-recorder is connected to the wire. It puts a small pulse of current into the wire, records a signal and the wire loop is retrieved. This takes less than an hour and is done while the MT station is being installed or removed.

Because vehicles used in this survey will remain on existing roads and off road access will be on foot, the physical impact of this survey will be insignificant.

### ***BLM and USDA FS Regulations***

The August 14, 2007 Federal Register Section 11.9 states that geophysical surveys for geothermal exploration of federal lands are eligible for a Categorical Exclusion (CX) when no temporary or new road construction is proposed. The grant of a CX is subject to a review of the list of "extraordinary circumstances" defined by Appendix 2 of 516 DM 2.3A(3). None of the listed items appear to apply to this survey. Therefore, this survey could be completed on USDA FS administered lands under a CX or on BLM administered geothermal leases as Casual Use allowed under existing permits.

Earlier BLM notices indicating that MT and TDEM surveys could be completed as a Casual Use activity at Glass Mountain included some local requirements. In all cases, a survey coordinator visited the local office of the USDA FS at the time the survey commenced to inquire about any temporary local restrictions, for example, to avoid nesting endangered birds. In 2005, the BLM required that the survey coordinator review the MT site locations with an archaeologist before the crew arrived. Of about 100 sites reviewed by an archaeologist for the 2005 MT survey at Glass Mountain, two were moved to avoid sites of potential although no specific historic interest.

### ***Public Benefits***

This MT-TDEM project is designed to reduce the impact of geothermal development by more fully characterizing the resource geometry. Besides reducing the likely number of exploration wells and pads required, the understanding of the resource geometry derived from the MT beyond the drilled area will allow the initial development to be designed with a view to long term minimization of impact by surface facilities.

### ***Purpose of MT and TDEM surveys in geothermal exploration***

MT is used in the geothermal industry to obtain images of rock resistivity to depths of many thousands of feet. Many case histories have demonstrated the capability of MT to map low resistivity smectite clays that form above geothermal reservoirs and their transition to more resistive illite clays at the high temperatures within geothermal reservoirs. The pattern of temperature in the upper reservoir can be used to infer bulk permeability and the relative productivity of wells. Based on this resistivity-clay-temperature-permeability chain of inference, MT is used to improve geothermal resource conceptual models and reduce the total number of wells and pads necessary to explore and appropriately develop geothermal resources. TDEM cannot detect resistivity patterns as deep as a geothermal reservoir but, because of its relative immunity to distortion, it reduces uncertainty in MT images. Both MT and TDEM surveys have negligible environmental impact.

### ***The MT method***

The MT method illustrated in Figure 1 uses electrodes and magnetometers to measure natural electric and magnetic fields at the surface of the earth caused by electromagnetic waves radiated from the sun and from distant electrical storms. The magnetic field varies slowly while the electric field responds more directly to the currents that it induces in rocks. The ratio of the electric to the perpendicular magnetic field is proportional to rock resistivity. An MT sounding is made by recording the electric and magnetic fields over a range of frequencies. The electric field of a high frequency electromagnetic wave dissipates at shallow depths whereas the field at low frequencies responds to a much thicker and deeper section of the earth. For geothermal applications, recording MT from 0.01 to 300 Hz provides resistivity imaging for a range of depths from about 300' to much greater than 30,000', covering the depth range of the transition from the low resistivity smectite clay zone above the reservoir to the higher resistivity illite clay zone in the reservoir.

Because MT uses natural signals, there is no option to increase the signal strength if cultural noise from power lines or roads disturbs the measurements. However, the MT signal sources, the sun and worldwide lightening, are usually strong enough to overcome most types of noise from 0.01 to 300 Hz if stations are recorded for more than 12 hours.

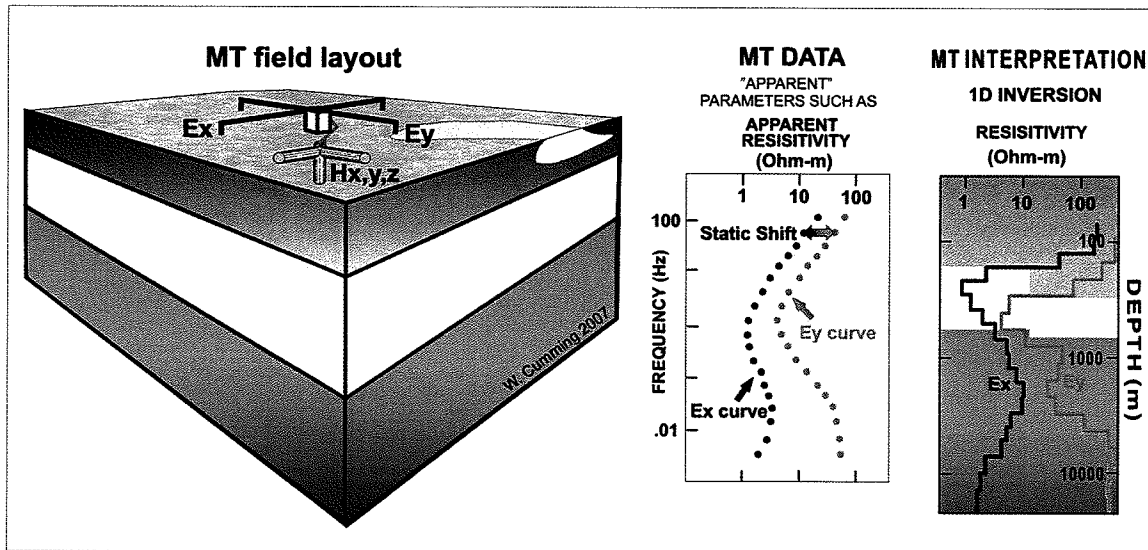


Figure 1. MT station layout, data recording and 1D resistivity models

### **MT station layout**

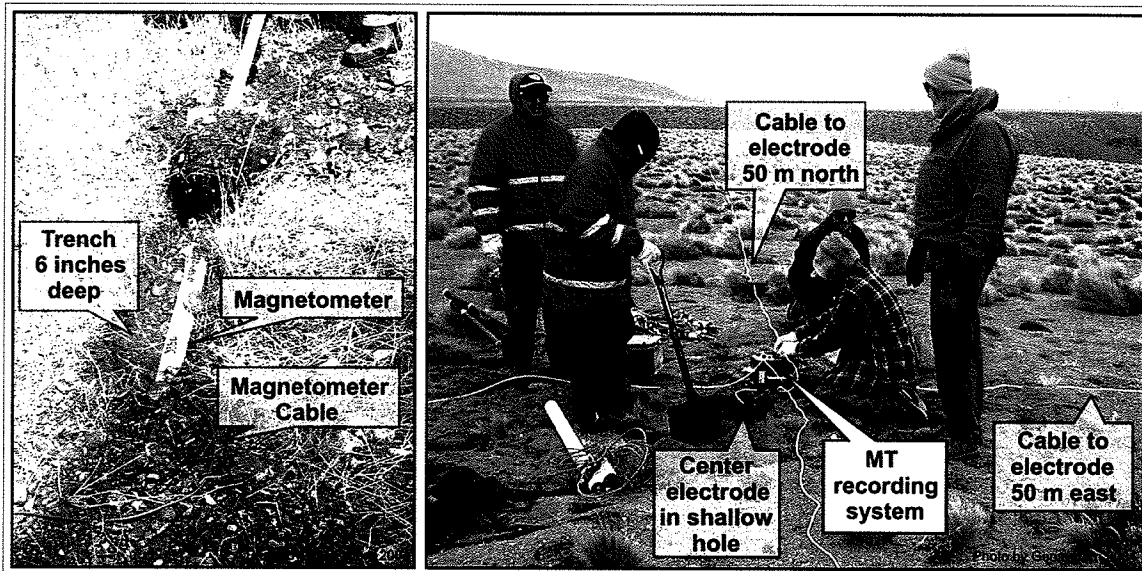
A set of MT equipment used to record a station for the planned survey consists of four insulated wires attached to five electrodes inserted into the ground, three coil magnetometers in PVC tubes about 48 inches long and 4 inches wide, a recording system about the size of a small piece of carry-on luggage, and a sealed battery (Figure 2).

Four insulated wires, each about 150 feet long, are laid out by hand in a plus-sign pattern and are electrically connected to the ground through five electrodes of two possible types. Porous electrodes are usually buried in small holes about 6 to 12 inches deep and 6 inches wide using a post-hole digger. If steel stake electrodes are used, they are usually hammered in to refusal or to a maximum of about 18 inches. In cases where it is difficult to achieve a good electrical contact with the rock or soil, a few quarts of fresh or slightly salty water and/or wet bentonite clay may be placed in the bottom of a hole dug for a porous electrode or pored beside a steel stake. The steel electrodes are faster to install but the electrically more stable porous electrodes are required when recording for times much longer than an hour.

To avoid wind vibration and resulting noise, the two horizontal magnetometers are usually buried in two 48 inch long, 6 inch deep trenches and the vertical magnetometer is partially buried in a 24 inch deep hole dug with a post hole digger. A plastic pail is placed over the protruding vertical coil to shield it from the wind.



The MT receiver and electrode lines are shown at right in Figure 2 with the operator and field crew while a magnetometer is shown being buried at left. These photos are from a desert survey where it is easier to see the system than at Glass Mountain where vegetation obscures most sites. After the magnetometers and electrodes are recovered and the soil and vegetation replaced, the disturbance is usually so small as to be difficult to find without accurate coordinates and GPS positioning.



**Figure 2. MT equipment field layout illustrating its environmental impact.**

After the electrodes and magnetometers are installed, the recording system is connected to the electrode wires and the magnetometer signal cables and data acquired. The system is usually left running unattended overnight unattended to collect 14 hours of data. Shallower data can be recorded in less than an hour. Depending on variations in the subsurface resistivity patterns, the spacing between MT stations may vary from several miles to a few hundred feet.

### ***Survey operation***

Survey operations are conducted by two or three independent crews, each consisting of two to five workers. They usually use only one vehicle per crew unless safe operation requires more. If the station site is not accessible by vehicle, the equipment can be easily carried to the site by two to five people using backpacks. The number of stations recorded by each crew varies depending on access and the depth of investigation required. It takes 20 to 60 minutes to lay out a station, 1 to 14 hours to acquire the data, and 30 minutes to pick up the station and move on. Each crew carries 1 to 3 recording systems and can record 2 to 6 MT soundings per day, depending on access and recording duration. For recordings of 14 hours duration, the equipment is usually left running overnight at the station, to be picked up the next morning.

### ***Telluric station option for T-MT***

In areas where restrictions are placed on the minimal soil disturbance caused by the emplacement of MT coils and electrodes or where burying coils is impractical, as seemed to be a possibility on the glass flows at Glass Mountain, an alternative method called T-MT can be used. In this method, telluric-only stations (the T part of the T-MT acronym) are recorded at the same time as two or more standard MT stations are recorded within 10 miles of the telluric stations.

Telluric stations in this context are MT stations without magnetic field measurements. They are acquired by carrying an MT recorder to the station location and connecting it using four wires 150 feet long to five small porous electrodes. In areas where no digging can be done, the porous electrodes are placed on the surface of the ground in contact with the underlying soil or rock. A quart of water may be poured on the ground to improve the electrode contact. If the electrode is placed on a hard surface like the volcanic lavas of Glass Mountain, wet clean clay would be patted onto the surface in a layer less than 4 inches wide and 1 inch thick and the electrode would be placed on that. The two to four person crew would leave the recorder to acquire data by itself for 1 to 12 hours and would then return to pick up the equipment. Any clay that was used would be removed after the measurement was completed for re-use at other stations. Acquiring a telluric station typically leaves no disturbance more significant than would occur if a "Leave No Trace" hiker walked through the area. If the resistivity variations are smooth and have few shallow vertical conductive zones, as is typical of geothermal prospects, there would be little or no loss of resolution from collecting telluric stations instead of MT stations.

Although the use of telluric stations with electrodes installed on the ground surface does have higher risk of collecting incomplete or noisy data, in cases where even minimal disturbance of the soil is of concern, it can be an effective option. Because variable sources of noise like wind have greater effect on surface electrodes, they are most effective when they are part of a larger conventional survey so that they can be acquired on the least windy days.

### ***MT environmental impact***

In the Medicine Lake area, more than two hundred MT soundings were acquired by geothermal operators and academic groups in the 1980's and 91 stations in 2005. These surveys left no permanent impact on the environment. Transient impacts may include vehicle traffic, foot traffic, and the easily restored minor soil disturbance caused by installing the electrodes and magnetometers. Sealed batteries are used so the survey has no generator noise. Safety concerns are minimal. The detection wires are measuring natural currents and so have no live current in them except in the very rare event of a direct lightning strike which would be dangerous for any activity.

### ***The TDEM method***

For both transmission and detection of signals, the time domain electromagnetic (TDEM or TEM) method relies on electromagnetic induction between an ungrounded wire loop and the earth. It requires no electrical contact with the earth which means that it is not

subject to the same types of electrode polarization distortion that can affect any method that measures the resistivity of the earth using electrodes, like MT. The most common TDEM approach is to send a steady current into a large wire loop laid out on the ground to generate a vertical magnetic field and then suddenly switch off the current, inducing decaying smoke rings of current in the earth as the magnetic field decays as in Figure 3. The decaying vertical magnetic field generates a voltage in a detection coil in the center of the loop that is recorded. The voltage decay in the detector depends on the resistivity pattern of the underlying rocks. Because the practical depth of investigation of TDEM is lower than of MT, the TDEM interpretation in Figure 3 shows only the top of the yellow conductor resolved.

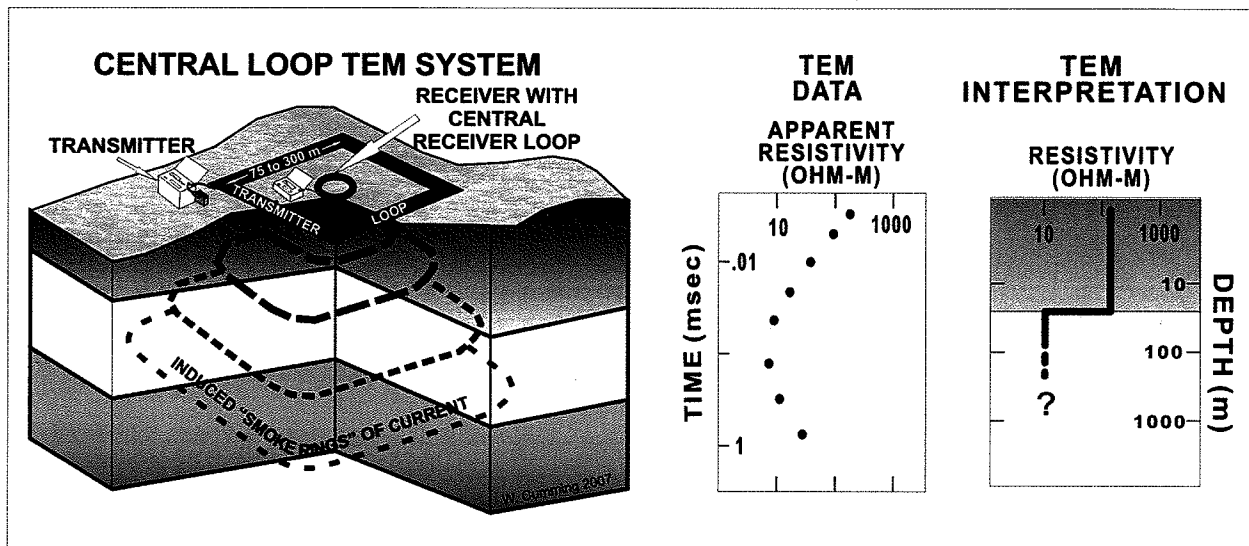


Figure 3. TDEM central loop field layout, data recording and resistivity model

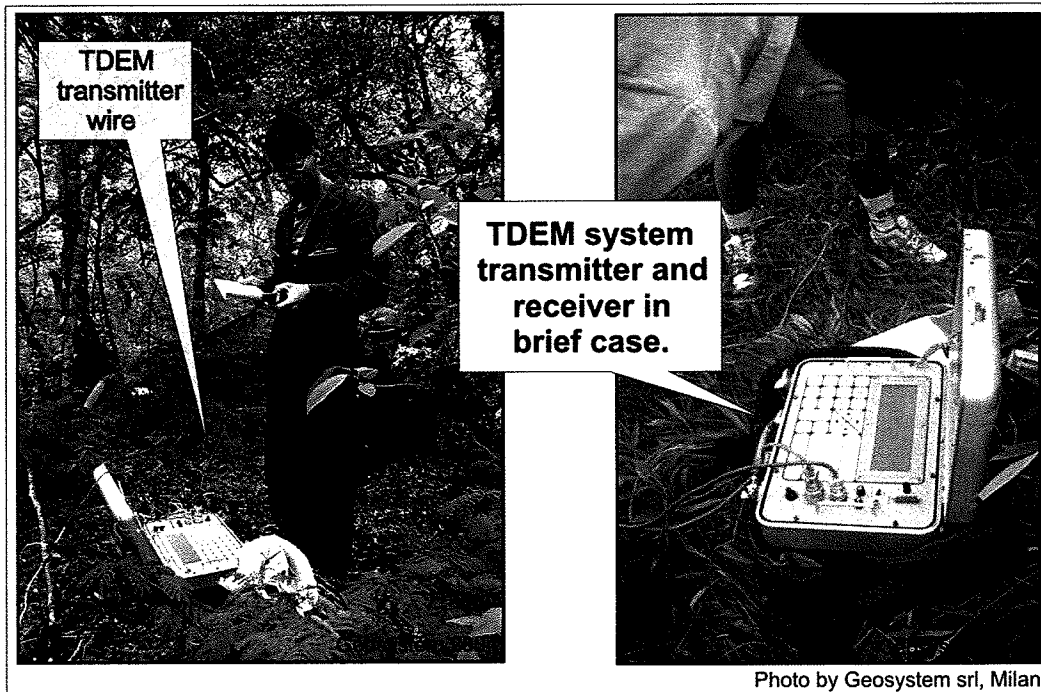
### Field procedures

TDEM survey operations are conducted by a crew of two to five workers, usually using only one vehicle. If the station site is not accessible by vehicle, TDEM equipment can be easily carried using backpacks. Depending on the size of loop used, it takes 15 minutes to several hours to lay out a station, 5 to 20 minutes to acquire the data, and 10 to 30 minutes to pick up the station and move on. Therefore, from 1 to 9 TDEM soundings per day can be acquired by a single crew, depending on loop size, with a 3000' loop taking a full day or more and a 150' loop taking less than an hour. A large loop requires a large generator that usually cannot be moved far from road access.

Depending on expected variations in the subsurface resistivity and the objectives of the survey, the TDEM loops may be laid out as individual stations separated by up to several miles, along continuous profile lines where the edge of one station coincides with an edge of an adjacent station, or at locations collated with an MT station. TDEM soundings at Glass Mountain include both several hundred distributed stations using 1000' loops and over 100 stations in profiles in which 1000' diameter loops are spaced at 1000' intervals so that one loop shares a common side with an adjacent loop. For the



proposed survey, 300' TDEM loops will be installed at each MT station at the time the MT station is set up or taken down.



**Figure 4. Sirotem TDEM receiver/transmitter and crew**

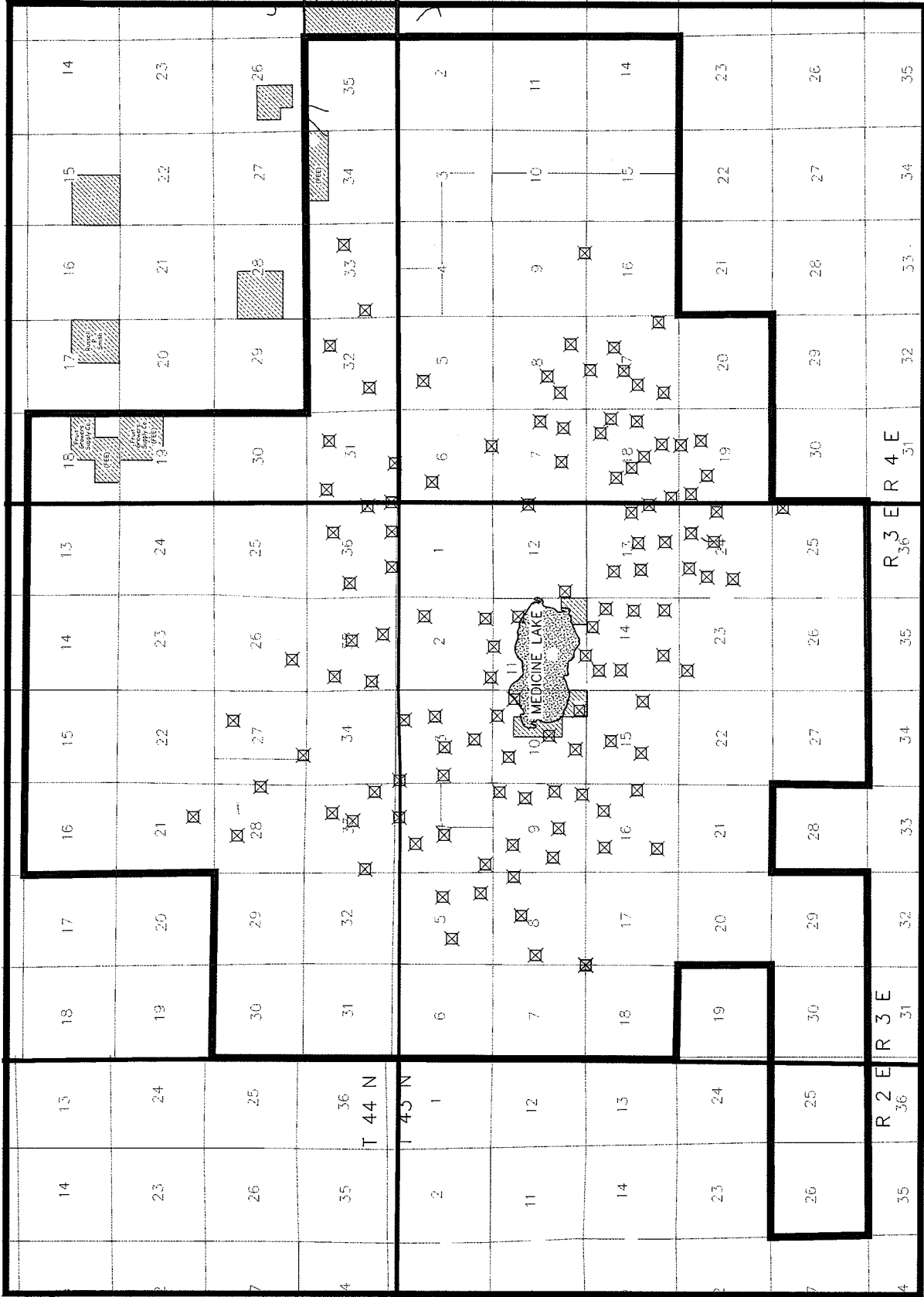
In the case of a Sirotem TDEM system like that used in the 2005 GSY-USA survey at Glass Mountain, the TDEM survey equipment consists of a wire loop antenna, a transmitter/receiver unit and a sealed battery. The transmitter/receiver setup is shown at left in Figure 4 and the operator with the field crew logging a measurement is shown at right. The loop antenna is a single strand of insulated wire laid out in a square about 300' on a side. When using a TDEM system in a forested area, as in the photographs, the transmitter wire is laid as close to the ground as possible so it is difficult to see where there is vegetation. The briefcase-sized transmitter/receiver box is connected at one corner of the loop and energizes the wire with a current from a sealed battery. The same loop is typically used to both transmit and then detect the signal response. The loop is normally laid out and retrieved by walking along its sides and paying out or re-coiling the wire by hand.

The Geonics EM37 system used by earlier TDEM surveys at Glass Mountain has a larger but still easily carried receiver/transmitter, a small gasoline generator to power the transmitter, and an auxiliary receiver coil that is hand carried to the center of the loop. With this system, a much larger loop over 1000' on a side is typically used in geothermal exploration. The system is still portable for dedicated TDEM crews but it typically cannot be included as part of an MT crew's equipment, as is the case for the much lighter Sirotem system.

#### ***TDEM environmental impact***

The most prominent transient impacts of a TDEM survey are vehicle traffic on existing roads near stations and hiking around the station location. For the larger loops that require a generator, there are a few minutes of local noise less intrusive than a snowmobile engine. Safety concerns are minimal. Because the TDEM transmitter loop is insulated, ungrounded, and the loop voltage and amperage is low in the type of geothermal TDEM survey planned, there is no electrocution hazard. Fire hazard is minimal, mainly related to a motor generator if one is used but, in any case, it is much lower than is typical of vehicle and small engine use in forested areas because it is run for short periods while stationary in a controlled location. The most significant public concern for TDEM surveys is usually the remote possibility of damage to vehicles getting tangled in the transmitter wire. Therefore, loops are not laid across roads.

Earlier TDEM surveys collected at Glass Mountain using Geonics EM-37 systems in the 1980's and a Geonics Protem system in 2002, all with generators and 1000' loops, had no significant impact on the environment. Sirotec systems that used only batteries and 300' loops were used for the 2005 survey. Because Sirotec systems are light enough to be carried with an MT crew, its impact is negligible.



Proposed MT / TDEM station locations (red symbols). Blue outline delineates Calpine Federal leases, except for green hatched areas that are not leased by Calpine.



STATION LOCATIONS in NAD27

2093372	819858
2094300	824593
2095619	820666
2096662	825126
2096883	822981
2098239	829529
2097820	821099
2098518	822719
2098930	818901
2099448	812948
2099512	815963
2099686	826670
2099625	821157
2100978	830258
2100139	836838
2100193	825066
2100587	818596
2101209	839323
2101184	827601
2101429	831438
2101587	816018
2102295	820476
2102631	829008
2102511	817258
2102640	821926
2102680	818831
2102910	835523
2102760	814111
2103287	827583
2103580	825105
2104707	833103
2104620	821414
2104874	813883
2105065	817654
2105171	825057
2105627	823368
2105550	815621
2105847	819152
2106670	837083
2106717	827346
2106917	825598
2106974	822072
2107281	817432
2107803	813806
2107924	821110
2108905	829204
2109189	831327
2109151	822454
2110411	817093
2109562	816332
2109590	815078
2109569	811275

2110149	833764
2110435	812640
2110905	822292
2111232	830358
2112028	816700
2111585	828572
2112499	822766
2112618	826224
2112608	820894
2112965	814350
2113000	812584
2113072	815950
2114051	818275
2114495	830484
2114783	808681
2114908	810162
2115200	815488
2115422	828068
2115297	813942
2115383	811181
2116821	814091
2116882	812565
2116896	809759
2117375	831439
2117434	828077
2117387	811075
2118549	814494
2118614	809617
2118884	829462
2118982	820357
2118839	805864
2119108	828104
2118980	813485
2119405	812217
2119818	831823
2119612	811089
2120263	825806
2120525	815371
2120665	810174
2121096	814481
2121337	827917
2121431	818497
2121730	813771
2122311	822451
2122589	831683
2122392	811683
2122441	812762
2122654	810532
2123062	816273
2123346	818396
2123719	819711
2123740	814191

2123879	815683
2125364	818586
2125387	812669
2125621	829390
2125824	814157
2126008	826317
2126288	819314
2126617	814948
2126650	816874
2128007	831639
2127937	815514
2128117	817989
2129394	812967
2130018	829640
2133302	817207
2133741	830860



Michelle Berditshevsky  
P.O. Box 1143  
Mt Shasta, CA 96067

Ginger Mike-Mercado  
40538 McArthur Rd.  
Fall River Mills, CA 96028

Floyd J. Buckskin  
P.O. Box 617  
Fall River Mills, CA 96028

Janie Painter, Chair  
Save Medicine Lake Coalition  
P.O. Box 34  
Mt. Shasta, CA 96067

Brian McDermott, County Administrator  
Siskiyou County  
P.O. Box 750  
Yreka, CA 96097

Howard Wynant, Chairman  
The Shasta Nation  
P.O. Box 34  
Macdoel, CA 96058

Joseph F. Kirk, Chairman  
The Klamath Tribes  
P.O. Box 436  
Chiloquin, OR 97624

Perry Chocktoot, Jr.  
The Klamath Tribes  
P.O. Box 436  
Chiloquin, OR 97624

Roy Hall Jr., Chairman  
The Shasta Tribe, Inc.  
10736 Quartz Valley Rd.  
Ft. Jones, CA 96032

Jessica Jim, Chairperson  
Pit River Tribe  
37014 Main Street  
Burney, CA 96013

Jim Shott  
Medicine lake Homeowners Association  
605 Glen Mar  
Mt. Shasta, CA 96067

Carole Plank  
Medicine Lake Homeowners Association  
605 Glen Mar  
Mount Shasta, CA 96067

Peggy Risch  
Mount Shasta Bioregional Ecology  
Center  
P.O. Box 1143  
Mount Shasta, CA 96067

Siskiyou County Board of Supervisors  
Attn: Bill Overman  
P.O. Box 338  
Yreka, CA 96097

Dwight Dutschke  
State Office of Historic Preservation  
P.O. Box 942896  
Sacramento, CA 94296-0001

Dave Bradshaw  
Modoc Co. Supervisor  
P.O. Box 59  
Lookout, CA 96054

Kyle Haines  
Klamath Forest Alliance  
P.O. Box 457  
Klamath Falls, OR 97601-9107

Sean Curtis  
P.O. Box 1692  
Alturas, CA 96101

Darca Morgan  
Sierra Forest Legacy  
915 20th St.  
Sacramento CA 95814

Eric Ryberg  
Center for Biological Diversity  
P.O. Box 710  
Tucson AZ 85702-0710



# MOUNT SHASTA BIOREGIONAL ECOLOGY CENTER

SAVE MOUNT SHASTA • SAVE MEDICINE LAKE HIGHLANDS • HONOR OUR MOUNTAIN ENVIRONMENT  
P. O. Box 1143 • Mount Shasta, CA 96067 • Phone & Fax 530.926.5655 • email [shastamedicine@snowcrest.net](mailto:shastamedicine@snowcrest.net)

July 18, 2008

Tim Burke, Field Manager  
Alturas Field Office  
708 West 18<sup>th</sup> Street  
Alturas, CA 96101

Laurence Crabtree, District Ranger  
Doublehead Ranger District, Modoc NF  
PO Box 369, Highway 139  
Tulelake, CA 96134

Re: Scoping Comments for the Environmental Assessment on Calpine's Proposal to conduct MT and TDEM geophysical surveys in the Glass Mountain KGRA

Dear Mr. Burke and Mr. Crabtree:

Thank you for this opportunity to be part of the environmental review process for the above-named Project Proposal. The Mount Shasta Bioregional Ecology Center (Ecology Center) submits the following scoping comments for an Environmental Assessment, as requested in BLM's June 12, 2008 request.

The Ecology Center agrees fully with the comments on this Project provided by the Pit River Tribe Environmental Department, and incorporates these by reference.

In addition, we submit the following issues and points for consideration:

## Cumulative impacts

The Ecology Center also questions the absence of cumulative impacts from the list of Probably Environmental Effects in the June 12, 2008 BLM letter.

The survey findings will have a bearing on the issue of reasonable and foreseeable future geothermal development in the KGRA, and will have reciprocal effects with projects currently approved and/or proposed. This includes the Telephone Flat geothermal project, which was approved based on impacts from it and the Fourmile Hill geothermal project, but did not contemplate further development. Since Calpine admits, in its March 4, 2008 Notice of Intent, that it intends to "accelerate the development of the resource," it is clear that other cumulative impacts need to be considered in the EA.

Calpine's avowed plans to develop up to 1000 megawatts in the Medicine Lake Highlands have never received analysis. Numerous solicitations to the California Energy Commission attest to Calpine's expanded plans in areas including (but evidently not limited to) the Pumice Mine area, and the Mount Hoffman Roadless Area.

The geophysical surveys appear to be part of a multi-phased project that has never been analyzed in an environmental document. Companies do not spend tens of thousands of dollars on research that has no relationship to future development.

The EA should state how these reciprocal concerns will be addressed, and how piecemealing of Calpine's overall development plans will be avoided.

### Alternatives

The EA should contain alternatives, including the No Project alternative to the proposed project, that would not conflict with the Medicine Lake Traditional Cultural District. The agencies should not buckle to Calpine's continuing threats of takings lawsuits, when the leases stipulations clearly provide for full compliance with all applicable laws.

### Shaky foundation of leases

In light of the Ninth Circuit decision on the Fourmile Hill geothermal project, the EA should consider whether this project should be deferred until the two current lawsuits challenging geothermal development of the Medicine Lake Highlands are fully resolved.

By leaving out survey locations within the Fourmile Hill area, BLM is acknowledging the invalidity of those leases. However, all the other proposed areas have similar circumstances, which led to illegal renewal of the leases there. It would be a flaw for the EA to assume valid leases, since all parties are aware of their disputed validity.

### Objectionable location of sites

Besides locations within sensitive cultural areas (the whole Medicine Lake Highlands, and numerous sites within the Highland fall under this description), we note that a large number of the geophysical survey sites are located close to water resources.

At least 10 sites appear to be located within a mile of Medicine Lake, despite Calpine's previous claims that no drilling would occur within a mile and a half of the Lake. Further, sites near Paynes Springs, and the other lakes (Blanche, Bullseye, No Name...) are of concern because of the potential impacts of the surveys on sensitive riparian areas, and on the waters themselves, especially in terms of what potential future plans may hold for these areas based on the findings of the surveys.



Sites within the Roadless Areas (Mount Hoffman and Dobie Flat) are also of major concern, as the man-made intrusions could affect their potential wilderness status.

### Questions

We ask that the Environmental Assessment address the following questions:

- whether coreholes, or temperature gradient holes, would be drilled as part of this project (some of the CEC solicitations have mentioned taking corehole samples)
- whether dynamite or any other explosives would be utilized at any point in the project (as was evidently done in the Fourmile Hill surveys);
- why the surveys are even being done, in light of the failed exploration wells and the minimal results obtained thus far.

### Monitoring and bonding

It is laughable that the proposal compares the project to a “Leave No Trace” hiker (see page 5 of the Calpine Notice of Intent). This is like saying that Godzilla walked through a pristine wilderness and only bent a fern!

Given Calpine’s past performance in conducting geophysical surveys in 2002, it is clear that a good monitoring program is needed, in order to assure that nothing more is done than what has been outlined in the project plan. Calpine’s similar project in 2002 involved cutting large swaths in the forests to do the surveys, with resulting impacts on biological, aesthetic, and possibly cultural resources (such as ethnobotanical species).

Especially due to Calpine’s clearly overstepping project specifications in 2002, BLM should ask the company to post a bond so that project impacts can be reclaimed, including any possible departures from the plan.

It can be surmised from Calpine’s proposal that they may need to cut down trees or create access roads (or at least trails) in vegetated areas in order to lay their 150-foot-long wires, carry out their activities, and to park their generators in convenient locations.

It is not clear that a single Tribal monitor could cover all aspects of the operation, including archaeology, ethnobotany, and keeping tabs on equipment, digging, and crews. Therefore the EA should contain a more appropriate monitoring plan.

### Questionable Technology

Based on the results of the geophysical surveys, Calpine will presumably propose new geothermal projects, in order to “accelerate the development of the resource.” How experimental is this technology, and what studies exist to prove that it is not just another pretext for subsidies and failed projects, such as the Fourmile Hill exploration project of 2002, which has left huge scars on the landscape. Or the highly controversial EGS acidification technology that is being approved without fully knowing where tens of thousands of gallons of these toxic substances may end up within this complex pristine aquifer?

Where else has this technology been utilized, and with what results?

The Medicine Lake Highlands must not become just another industrial proving ground for questionable technology!

In conclusion, the Forest Service denied Calpine’s proposal, based on input by the Pit River Tribe and the State Historic Preservation Officer, and BLM should follow suit for all the same good reasons. It is clear that no public benefit is there. The only benefit would be to the company, as approval of the project would qualify them for more subsidies, taking funds away from projects that are truly green and sustainable. This proposal signals that intrusions into sacred pristine areas are permissible, despite the cultural preservation agencies’ disapproval. This goes deeply against the spiritual and cultural meaning that is invested in the Medicine Lake Highlands by Native Americans and by tens of thousands of people annually.

Thank you for this opportunity to comment. We incorporate by reference the comments made by Medicine Lake Citizens for Quality Environment, the Save Medicine Lake Coalition, the Klamath Forest Alliance, and as stated before, the Pit River Tribe. Please keep us informed of any actions relative to this and similar projects within the Medicine Lake Highlands.

Very truly yours,

Michelle Berditschevsky  
Michelle Berditschevsky  
Director

cc: Pit River Tribe Environmental Department  
Deborah Sivas, Esq.  
Klamath National Forest  
Shasta-Trinity National Forest  
California State Historic Preservation Officer  
Advisory Council on Historic Preservation





**Medicine Lake Citizens for Quality Environment, Inc.**  
**Save Medicine Lake Coalition**  
**PO Box 34**  
**Mount Shasta, CA 96067**  
**Phone: 530-926-5514 ~ Fax: 530-926-1598**

July 16, 2008  
Sent via e-mail and US Postal Service

Timothy Burke, Field Manager  
Alturas Field Office  
708 West 12<sup>th</sup> Street  
Alturas, CA 96101

**Re: GEOTHERMAL RESOURCE EXPLORATION OPERATIONS**  
**aka: GEOPHYSICAL SURVEYS**

Dear Mr. Burke,

Mr. Andrew J. Whittome's March 4, 2008 Letter of Intent clearly spells out Calpine's objective to initiate *geothermal resource exploration operations*. The Telephone Flat ROD states the terms and conditions under which Calpine may proceed. The ROD also requires consultations with the affected Native American tribes, the Native Coalition and the State Historic Preservation Office, as well as review opportunities for the Telephone Flat Oversight Committee.

**ENVIRONMENTAL ASSESSMENT:**

The proposed Environmental Assessment (EA) needs cover all phases of Calpine's exploration activities. Calpine cannot be allowed to piecemeal exploration activities. A complete and comprehensive EA must address all of the significant impacts of all exploration and include the appropriate mitigation measures.

The cumulative effect of all of Calpine's *geothermal resource exploration operations* need to be thoroughly evaluated in the EA. The proposed geophysical surveys must be completely analyzed in regards to the role that the surveys would play in escalating or promoting full-blown geothermal industrial development within the Glass Mountain KGRA.

According to various Calpine representatives and government agencies, Calpine would not or would never be allowed to conduct any sort of geothermal exploration operations around or near Medicine Lake or any of the other lakes or streams in the area. According to the MT/TDEM Station Map, Calpine intends to conduct numerous *geothermal resource exploration operations* around Medicine Lake, Little Medicine Lake, Paynes Springs, Schonchin Springs, Blanche Lake and even in the middle (?) of Bullseye Lake. We strongly object to any and all of the proposed geothermal exploration operations around the lakes and streams of the Medicine Lake Highlands.

We further object to Calpine conducting any kind of activity within the Mount Hoffman Roadless Area. Calpine may consider this exploration phase of no consequence but any sort of ground disturbance in that area would be significant and possibly long term. The pristine qualities of the Mount Hoffman Roadless Area must remain intact and forever protected from detrimental means.

Depending on when Calpine actually begins their geophysical surveys, USFS wildlife personnel need to be on site to monitor the activities around or near avian structures and known denning areas. For instance, a few of Calpine's proposed exploration sites in the Telephone Flat area are near osprey nests. There are also two known Bald Eagle nests, in the forests on the south-side of Medicine Lake that could be disturbed by the survey activity. In-the-field consultation with USFS wildlife experts, familiar with the different regions, could help guide Calpine away from sensitive nesting and denning areas, thus distressing human contact could be reduced or even eliminated.

Many of the proposed exploration sites are in mountainous areas that have no access roads or the nearest roads are closed to vehicular traffic. Calpine must adhere to and respect the different Forest's road closures while conducting the proposed exploration activities. Calpine vehicles must not be allowed to go off-road to access their proposed sites or cut trees and/or clear debris from closed roadways

Thank you for the opportunity to comment on Calpine's geophysical survey phase. To avoid Project piecemealing, we are relying on an accurate and complete EA that appropriately addresses and includes all exploration phases, significant impacts and mitigation measures for Calpine's geothermal resource exploration operations.

We would appreciate written confirmation that Calpine has completed all of the required terms and conditions of the Telephone Flat ROD prior to approval of any exploration operations and/or geophysical surveys within the Glass Mountain KGRA.

Sincerely,

*Janie Painter*

Janie Painter, chair MLCFQE

Cc:

Stephan C. Volker, Esq.

Laurence Crabtree, USFS

Michelle Berditchevsky, Native Coalition

Peggy Risch, MSBEC

# Pit River Tribe Environmental Department

37118 Main Street • Burney, CA 96013  
phone 530 335-5062 • fax 530 335-5069 • email [shastamedicine@snowcrest.net](mailto:shastamedicine@snowcrest.net)

July 18, 2008

Tim Burke, Field Manager  
Alturas Field Office  
708 West 18<sup>th</sup> Street  
Alturas, CA 96101

Laurence Crabtree, District Ranger  
Doublehead Ranger District, Modoc National Forest  
PO Box 369, Highway 139  
Tulelake, CA 96134

Re: Scoping Comments for the Environmental Assessment on Calpine's Proposal to conduct MT and TDEM geophysical surveys in the Glass Mountain KGRA

Dear Mr. Burke and Mr. Crabtree:

The Pit River Tribe Environmental Department submits the following scoping comments containing concerns about Calpine's Notice of Intent to Conduct Geothermal Resource Exploration Operations of March 4, 2008, in response to BLM's request of June 12, 2008 for scoping comments for an Environmental Assessment for the proposed project.

These comments do not in themselves represent the required Section 106 consultation with the Pit River under the National Historic Preservation Act or the Medicine Lake Historic Properties Management Plan. Rather, these comments are in preparation for the August 14, 2008 meeting, at which time we understand this Project will be discussed with the Pit River Tribal Council, and to give input to BLM and the Forest Service in response to your request of June 12, 2008 for scoping comments for an Environmental Assessment for the proposed project.

## **A. Unanswered questions regarding the initial denial of this project**

The U.S. Forest Service initially denied this project in its letter of February 20, 2008 responding to Calpine Corporation's proposal to conduct Magnetotelluric (MT) and Time-Domain Electromagnetic Method (TDEM) geophysical surveys within the Glass Mountain KGRA ("Proposal"). The entire KGRA is within the area defined as Eligible for Listing on the National Register of Historic Places. The State Historic Preservation Officer ("SHPO") indicated in no uncertain terms, on February 14, 2008, that "...the undertaking will adversely affect all of the qualities, characteristics, attributes and features that make the TCD (Medicine Lake Area Traditional Cultural Places District), and any other properties that may be culturally and traditionally associated with the TCD, eligible for inclusion in the National Register." The SHPO agreed with the Forest Service, and requests that the agencies "carefully consider the no project alternative."

As the agency that has jurisdiction over the National Forest lands where the Proposal would be implemented, the Forest Service is authorized to deny the Project. We commend the Forest Service for thus honoring the sacred Tribal significance of the Medicine Lake Highlands.



It is not clear to us why this decision to deny the Project is being reconsidered. Calpine has shown itself to be financially irresponsible to the extent that the company had to spend two years in IRS Chapter 11 bankruptcy while it was “reorganizing,” and the geothermal leases were evidently suspended, a situation that apparently continued beyond Calpine’s emergence from bankruptcy. We would like to see a clear explanation of this situation, and why Calpine continues to insist on developing this sacred area, in spite of repeated evidence that development would be in conflict with age-old Tribal interests.

We continue to hold the position that the Project should be denied for all the reasons stated by the SHPO and the Forest Service in the above-mentioned letters, and the numerous Tribal consultations regarding the inappropriateness of industrial development in the sacred Medicine Lake Highlands.

### **B. BLM’s list of Probable Environmental Effects/Issues is incomplete**

In its June 12, 2008 letter, BLM listed a number of Probable Environmental Effects/Issues to be covered in the Environmental Assessment for the Project.

1. Cumulative Effects. Missing from this list are Cumulative Effects of the Project, which is clearly only the first stage of Calpine’s ambitions in the Medicine Lake Highlands. Calpine’s stated objective for the proposal is to conduct the surveys in order to “better refine the location and extent of geophysical anomalies and reduce the number and extent of exploration wells needed to locate the resource. This will accelerate the development of the resource....”

It is clear to all who love the Medicine Lake Highlands that this project represents only the first phase of a massive attempt to industrialize the Medicine Lake Highlands with a number of power plants, dozens of wells with associated drill rigs, noise, 24 hour lighting, air and water pollution, and destruction of the sacred atmosphere, natural qualities, and silence that now make the Highlands a place of mystery and healing where the Creator’s imprint is still apparent.

The proposed Project has the potential to greatly expand Calpine’s operations in the Medicine Lake Highlands, and full disclosure of that potential must be included in the Environmental Assessment. The surveys have the potential of *increasing* geothermal exploration and development in the Medicine Lake Highlands far beyond what has previously been proposed. Therefore, the surveys have the potential to spread industrialization over a much greater area, with increased cumulative adverse impacts to environmental and cultural resources and values.

According to the maps and other information provided, the surveys would cover a large portion of the Medicine Lake Highlands. The proposal area includes the Traditional Cultural District and extremely sensitive sites within the District. Ever since the first consultations with the Pit River Tribe (Tribe) in 1996 regarding geothermal development in the Medicine Lake Highlands, the Tribe has voiced strong objections to any proposals that would lead to industrial geothermal development of the area. It is evident that the proposed surveys fall within a highly significant spiritual and cultural area to which the Tribe's often-stated concerns regarding development of the Medicine Lake Highlands are applicable. All previous input by the Tribe regarding geothermal development in the Medicine Lake Highlands is herein included by reference.

2. Water Resources. Even though the BLM June 12, 2008 requests mentions that water resources have been identified among Probably Environmental Effects, we want to point out that the proposed surveys would be conducted close to water resources including but not limited to the shores of Medicine Lake, and near Paynes Springs, Blanche and Bullseye Lakes. These water resources are critical to the Medicine Lake Highlands aquifer and to the Fall River Springs and other springs that depend on the aquifer. Discovering geothermal resources near the Highlands' waters has the potential of affecting these water resources by encouraging and possibly increasing directional drilling from existing exploration sites, as well as drilling from foreseeable future projects. Directional drilling has the potential to add to the cumulative impacts on water resources of projects. A big concern is that these additional impacts may go unnoticed if directional drilling is approved or covertly done from wells within existing exploration sites or from other projects.

3. Sensitive Cultural Sites. The surveys would be conducted on sensitive cultural sites, including but not limited to Red Shale Butte, Mount Hoffman, Glass Mountain, Pumice Craters Glass Flow, Medicine Glass Flow, Medicine Mountain, several Roadless Areas, the above-named water resources, and numerous other sites. A field visit with the affected Band representatives and Environmental Department staff is needed to determine potential impacts on these sites.

4. Impacts on the forest and culturally important plants. It is not clear whether the survey methods would involve clearing of forested areas in order to bring the equipment to and conduct operations on the proposed sites. This concern comes from the fact that the impacts of previous geophysical surveys done in the Fourmile Hill area far exceeded the impacts stated by Calpine. The 2002 Fourmile Hill surveys involved cutting large areas of forest, in spite of Calpine's assurances that the surveys would not involve clearing, excavation, or additional roads (either constructed or rehabilitated).

Because of this previous poor performance, and because the current survey proposal clearly involves some excavation, a Monitoring Plan needs to be developed as part of the review process. It is not reasonable to hope that a single Tribal monitor would catch all possible impacts by the Project.

### **C. Status of geothermal leases is uncertain**

Given the enormous change in conditions since the geothermal leases which this Project presupposes were awarded and extended, it seems to us that conflict and disputes regarding the status of the geothermal leases need to be resolved before any further projects are considered.

The Ninth Circuit Court was clear in invalidating the lease renewals for that project (and we understand that Fourmile leases are not part of the current Proposal). However, all leases in the KGRA are potentially equally invalid, since they were renewed under similar circumstances. Leases on which the Project would be based could also be declared invalid when the Pit River Tribe's second lawsuit is adjudicated.

Therefore, it seems unwise to consider a Project that has the potential of increasing Calpine's investment in the Medicine Lake Highlands, before resolution of the Tribe's lawsuits is accomplished.

### **D. The Forest Service has not resolved conflicts in the Modoc National Forest Land and Resource Management Plan (LRMP)**

While the Forest Service clearly stated, in its February 20, 2008 letter, that the Proposal is "inconsistent with standards and guidelines in the Modoc National Forest LRMP," there is clearly a conflict of objectives within the LRMP. The conflict results from the need to address a significant change in the information available since the LRMP was first formulated.

The results of the NHPA Section 106 process, and of the NEPA process, on the Fourmile Hill and Telephone Flat geothermal developments have not yet been incorporated by a Forest Plan Amendment. A Forest Plan amendment was called for by the 2000 MOA for the Fourmile Hill Project, and that stipulation has been incorporated into the Historic Properties Management Plan for the Medicine Lake Highlands.

As a result, it cannot be adequately determined whether the proposed Project violates the LRMP, as the LRMP needs to be updated in light of new information.

### **E. Request for additional information**



We would like to request any information that is available relative to the 2005 geophysical surveys that were conducted, as the current Proposal states that there is a relationship between those surveys and the ones in the present Project. What data, if any, determined that these additional surveys are necessary? How would the new surveys complement the 2005 surveys? What areas did the 2005 surveys identify as having the most potential for geothermal production? We make this request informally. However, if necessary, please consider it a request under the Freedom of Information Act and its provisions.

PIT RIVER TRIBE ENVIRONMENTAL DEPARTMENT COMMENTS ON PROPOSED GEOPHYSICAL SURVEYS  
• PAGE 5

Thank you for your consideration of these comments, and for your response in addressing these concerns.

Very truly yours,

Michelle Berditshevsky  
Michelle Berditshevsky  
Environmental Coordinator

cc: Pit River Tribal Council  
Deborah Sivas, Esq.  
Klamath National Forest  
Shasta-Trinity National Forest  
California State Historic Preservation Officer  
Advisory Council on Historic Preservation

# **APPENDIX B: SOILS MAP LEGEND**

## Appendix B: Soil Map Legend

Map Number	Soil Description
<b><i>Shasta-Trinity National Forest Survey Area</i></b>	
64	Fons family, 25 to 50 percent slopes
246	Revit family, 10 to 40 percent slopes
247	Revit-Sheld families complex, 15 to 45 percent slopes
253	Rock outcrop, volcanic
273	Rock outcrop, Washougal family association, 0 to 35 percent slopes
293	Sheld family, 0 to 20 percent slopes
298	Sheld family, rock-outcrop association, 15 to 50 percent slopes
307	Stonewell family, 0 to 20 percent slopes
357	Yallani family, pumice overburden, 0 to 20 percent
362	Yallani family, pumice overburden, rock outcrop association, 0 to 25 percent slopes
<b><i>Klamath National Forest Survey Area</i></b>	
64st	Fons family, 25 to 60 percent slopes
104	Belzra-Wintoner, pumice overburden families complex, 2 to 15 percent slopes
105	Belzar-Wintoner, pumice overburden families complex, 15 to 50 percent slopes
108	Cinder lands
146	Inville-Wintoner families complex, 2 to 15 percent slopes
152	Lava flows
161mf	Divers-Lapine-Kinzel families association, 2 to 15 inch pumice overburden, 2 to 30 percent slopes
162mf	Divers-Lapine-Kinzel families association, 35 to 55 percent slopes
163mf	Divers-Lapine families rock outcrop association, 5 to 15 inch pumice overburden, 2 to 30 percent slopes
173	Redcap-Stonewell families association, 2 to 30 percent slopes
193mf	Kinzel-Lapine-Divers families association, 2 to 12 inch pumice overburden, 1 to 15 percent slopes
253st	Rock outcrop, volcanic
278mf	Yallani-Inville families complex, 8 to 20 inch pumice overburden, 5 to 30 percent slopes
307st	Stonewell family, 0 to 20 percent slopes
<b><i>Modoc National Forest Survey Area</i></b>	
64st	Fons family, 25 to 50 percent slopes
161	Divers-Lapine-Kinzel families association, 2 to 15 inch pumice overburden, 2 to 30 percent slopes
162	Divers-Lapine-Kinzel families association, 35 to 55 percent slopes
163	Divers-Lapine-Kinzel families association, 5 to 15 inch pumice overburden, 2 to 30 percent slopes
186	Inville-Yallani families complex, 10 to 20 inch pumice overburden, 2 to 20 percent slopes
193	Divers-Lapine-Kinzel families association, 2 to 12 inch pumice overburden, 1 to 15 percent slopes
197	Lapine-Divers families association, 10 to 24 inch pumice overburden, 20 to 40 percent slopes
198	Lapine-Divers families association, 10 to 24 inch pumice overburden, 40 to 60 percent slopes



## Appendix B: Soil Map Legend

Map Number	Soil Description
199	Lapine-Wuksi-Divers families association, 2 to 8 inch pumice overburden, 5 to 30 percent slopes
246st	Revit family, 10 to 40 percent slopes
260	Stonewell family, 40 to 60 inch pumice overburden, 15 to 40 percent slopes
261	Stonewell-Yallani families association, 6 to 20 inch pumice overburden, 5 to 30 percent slopes
262	Stonewell-Yallani families association, 35 to 70 percent slopes
263	Stonewell-Tallani families association, lithic xerorthents, frigid association, 30 to 55 percent slopes
273st	Rock outcrop, Washougal family association, 0 to 35 percent slopes
277	Yallani-Sheld families complex, 5 to 30 percent slopes
278	Yallani-Inville families complex, 8 to 20 inch pumice overburden, 5 to 30 percent slopes
298st	Sheld family-rock outcrop association, 15 to 50 percent slopes
362st	Yallani, pumice overburden-rock outcrop association, 0 to 25 percent slopes
V	Lava flow rock
W	Water

# **APPENDIX C:**

**MEMORANDUM OF AGREEMENT AMONG THE  
U.S. DEPARTMENT OF AGRICULTURE,  
FOREST SERVICE, U.S. DEPARTMENT OF THE  
INTERIOR, BUREAU OF LAND MANAGEMENT,  
CALIFORNIA STATE HISTORIC PRESERVATION  
OFFICER AND THE ADVISORY COUNCIL ON  
HISTORIC PRESERVATION REGARDING THE  
FOURMILE HILL GEOTHERMAL  
DEVELOPMENT PROJECT**

**MEMORANDUM OF AGREEMENT**  
**among the**  
**U.S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE,**  
**U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT,**  
**CALIFORNIA STATE HISTORIC PRESERVATION OFFICER**  
**and the**  
**ADVISORY COUNCIL ON HISTORIC PRESERVATION**  
**regarding the**  
**FOURMILE HILL GEOTHERMAL DEVELOPMENT PROJECT**

WHEREAS, the U.S. Department of Agriculture, Forest Service (USFS), on behalf of the Klamath, Modoc, and Shasta-Trinity National Forests, and the U.S. Department of the Interior, Bureau of Land Management (BLM), on behalf of the Alturas Field Office, propose to authorize Calpine Corporation's (Calpine) Fourmile Hill Geothermal Development Project (Project) as described on pages 2-4 through 2-60 of the Final Environmental Impact Statement and Final Environmental Impact Report, dated September, 1998, within the Medicine Lake Highlands (Highlands) in Siskiyou and Modoc Counties, California; and

WHEREAS, the USFS and BLM have determined that the Project may have adverse effects on historic properties in the Highlands, including, but not limited to, the properties determined eligible for inclusion in the National Register of Historic Places by the Keeper of the National Register in her letter of July 16, 1999; and that such potential adverse effects include, but may not be limited to, physical, visual, and auditory impacts, and impacts on the qualities attributed to the Highlands by Indian Tribes and others; and

WHEREAS, concern has been expressed by Tribal governments, organizations, and others about the cumulative impacts of the Project and of other actions under USFS and BLM jurisdiction on National Register qualities, justifying that special attention be given to the comprehensive management of the Highlands by the USFS and BLM; and

WHEREAS, the USFS and BLM have consulted with the California State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (Council) in accordance with Section 106 of the National Historic Preservation Act, 16 U.S.C. 470 (NHPA), and its implementing regulations (36 CFR Part 800) to resolve the adverse effects of the Project on historic properties; and

WHEREAS, pursuant to 36 CFR 800.6(b), the USFS, BLM, SHPO, and Council have consulted with the Klamath Tribes, Pit River Tribe, Shasta Nation, Shasta Tribe Incorporated, the Modoc Tribe of Oklahoma (collectively, Tribes), the Bonneville Power Administration, Calpine, and the Native Coalition for Cultural Restoration of Mount Shasta and Medicine Lake Highlands Defense (Coalition), and, pursuant to 36 CFR 800.6(c), have invited them to concur in this Memorandum of Agreement (Agreement);

NOW, THEREFORE, the USFS, BLM, SHPO, and Council agree that the following stipulations



shall be implemented in order to take into account the effects of the Project on historic properties, and that these stipulations shall govern the Project and all of its parts until this Agreement expires or is terminated.

## **STIPULATIONS**

The USFS and, as stipulated below, the BLM shall ensure that the following measures are carried out:

### **I. HISTORIC PROPERTIES MANAGEMENT PROGRAM**

A. Regardless of whether the USFS and/or BLM authorize the Project, within six (6) months of the effective date of this Agreement, the USFS, in consultation with the BLM, Tribes, Coalition, SHPO, Council, and other interested parties, shall initiate and diligently pursue a process that will lead to development of a Historic Properties Management Program (Program) for the Highlands. The Program will:

(1) Define the cultural values of the Highlands, and desirable conditions with respect to those values, including, but not limited to, the following:

- (a) air quality;
- (b) water quality;
- (c) forest health;
- (d) natural auditory qualities;
- (e) viewsheds and other visual qualities
- (f) traditional uses of and beliefs about the Highlands by the Tribes;
- (g) spiritual qualities;
- (h) relationships to other traditional cultural properties;
- (i) medicinal and other native plants;
- (j) archaeological research values;
- (k) values associated with specific historic properties;

(2) Based on the above, define the geographic boundaries of the area of traditional cultural significance of the Highlands, with the understanding that projects and other actions under USFS or BLM jurisdiction or control taking place outside the boundaries of this area may adversely affect the traditional cultural significance of the Highlands, and that such effects must be considered in accordance with the Program;

(3) Identify mechanisms for preserving and enhancing the cultural values of the Highlands, including, but not limited to, the following:

- (a) acquisition of lands, easements, and rights-of-way;
- (b) cooperative actions with property owners, recreational users, and others;

- (c) management prescriptions;
- (d) public education and participation programs;
- (e) evaluation of proposed projects on federal lands in and around the Highlands with reference to the cultural values of the Highlands;
- (f) management attention to geographic areas of ongoing or potential cumulative impacts on historic properties or cultural values, including the vicinity of Dry Lake managed by the Modoc National Forest, or subject to effects by USFS or BLM actions.

B. As part of the process cited in stipulation I.A above, and in consultation with SHPO, Tribes, the Coalition, and other interested parties, the USFS, in cooperation with the BLM, shall establish a timetable, with goals, for completing a Historic Properties Management Plan and implementing the Program.

C. The USFS and BLM shall inform the public of the Program, invite public participation, and proceed to implement the Program, in consultation with Tribes, the Coalition, SHPO, the Council, and other interested parties. The USFS and BLM will carry out their actions affecting the Highlands, including their respective decision-making regarding projects proposed by others, in a manner consistent with the Program.

D. Within 6 (six) months of completion of the Program (stipulations I.A-C), or within 5 years of the execution of this Agreement, the USFS shall assess the need to amend land and resource management plans (LRMP) for the Klamath, Modoc, and Shasta-Trinity National Forests and change management direction to protect the values that make properties in this area eligible for inclusion in the National Register of Historic Places. If an amendment is needed, at least one alternative set forth in the amendment process will provide the maximum possible protection to the cultural values associated with the Highlands. The USFS shall consult with the parties to this agreement, and with other parties that express an interest in participating, throughout the process of developing amendments to the LRMPs.

E. After the effective date of this Agreement, and prior to the adoption of the Program related amendments to the LRMPs, the USFS and the BLM shall evaluate proposed projects on USFS or BLM lands, or under the agencies' jurisdiction or control, for impacts to cultural values of, and to other historic properties in, the Highlands. In making its evaluations, the USFS will proceed in accordance with its Regional Programmatic Agreement (Programmatic Agreement among the U.S.D.A. Forest Service, Pacific Southwest Region, California State Historic Preservation Officer, and Advisory Council on Historic Preservation regarding the Process for Compliance with Section 106 of the National Historic Preservation Act for Undertakings on the National Forests of the Pacific Southwest Region), and the BLM will proceed in accordance with its BLM/SHPO State Protocol (State Protocol Agreement Between the California State Director of the Bureau of Land Management and the California State Historic Preservation Officer Regarding the Manner in which the Bureau of Land Management will meet its Responsibilities under the National Historic Preservation Act and the National Programmatic Agreement Among the BLM, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers). If the USFS or BLM determines that any project may have an adverse effect on the traditional cultural values of, or on any other historic property in, the

Highlands, the USFS or BLM will promptly notify the other parties to this Agreement and request their comments on the proposed action, and proceed in accordance with 36 CFR 800.

F. With the assistance of the USFS Regional Office, the Modoc, Klamath, and Shasta-Trinity National Forests shall diligently request, through their budgetary processes, additional funding to complete the Program and LRMP amendment(s) provided for in this Agreement.

G. The USFS or the BLM shall notify the public of all meetings and other Program activities, and invite the public to attend meetings and participate in development of the Program.

H. The USFS shall develop and implement the Program in consultation with the BLM, SHPO, Council, Tribes, and Coalition, as well as with other parties that may ask to participate; and carry out its actions affecting the Highlands, including its decision making regarding projects proposed by others, in a manner consistent with the Program;

I. The BLM shall cooperate with the USFS in development and implementation of the Program, and shall ensure that its actions in or affecting the Highlands are carried out in accordance with the Program.

## **II. RESOLUTION OF PROJECT EFFECTS**

If the USFS and/or BLM approve the Project, the approving agency or agencies shall ensure that the effects of the Project on historic properties are resolved as follows:

A. **Auditory Effects.** In continuing consultation with Tribes, the Coalition, and others, the approving agency or agencies will identify locations where natural quiet is important to cultural use of the area by the Tribes. To the maximum practicable extent, the approving agency or agencies will ensure that Project activities are inaudible at each such location. Noise will be controlled through the use of mufflers, baffles, and other noise-deadening devices, through careful control of pipe and machinery handling, and through scheduling and other means developed in consultation with Calpine, the Tribes, and the Coalition. The approving agency or agencies will use the modeled noise levels on Attachment 1, dated April 10, 2000, and titled "Modeled Noise Levels Associated with Traditional Cultural Properties and Activities with the Fourmile Hill Geothermal Project," plus on-the-ground monitoring, in determining the actual effectiveness of the noise-deadening devices.

B. **Visual Effects.** In continuing consultation with Tribes, the Coalition, and others, the approving agency or agencies will identify locations where seeing Project activities or their byproducts (e.g., steam plumes, power transmission lines, pipes, etc.) may impact the cultural use of the area by the Tribes. To the maximum practicable extent, the approving agency or agencies will ensure that such activities and their byproducts are not visible from such locations, or, if invisibility cannot be achieved, that visibility is minimized. Visual impacts will be controlled through scheduling to avoid conflict with tribal use of the area, through the use of nonspecular and appropriately colored facilities and construction materials, through the use of

light shrouds, through cooling tower design to facilitate dissipation, and through other means developed in consultation with Calpine, the Tribes, and the Coalition. The approving agency or agencies will use the estimated visual impacts on Attachment 2, dated April 10, 2000, and entitled "Fourmile Hill Geothermal Project Visual Impacts with Mitigation Measures," plus on-the-ground monitoring, in determining the actual effectiveness of the cooling tower design, light shrouds, and transmission line design.

C. Effects on Access. In accordance with E.O. 13007, the approving agency or agencies shall ensure that Tribes are afforded free and unrestricted access to public lands in the Highlands, including the Project area, to the extent permitted by safety considerations and resource protection needs, and to the extent consistent with applicable laws and regulations, before, during, and after the life of the Project.

D. Effects on Archaeological Sites.

(1) In consultation with the SHPO, Tribes, the Coalition, and Calpine, the approving agency or agencies shall ensure that archaeological sites subject to direct (e.g., well drilling, construction) and indirect (e.g., artifact collecting, vandalism) effects resulting from the Project are identified, and that the sites are protected from such effects. Protection shall be achieved through such means as Project design, relocation of Project facilities, and site burial.

(2) Where protection cannot be successfully implemented, the USFS and/or BLM shall ensure that archaeological sites are subjected to data recovery in a manner consistent with contemporary archaeological practice balanced with the interests of the Tribes.

(3) Should there be disagreement among Tribes as to whether and/or how to conduct data recovery, or otherwise avoid or minimize effects on a site, the approving agency or agencies shall afford the Tribes every reasonable opportunity to resolve the disagreement, and, in consultation with the SHPO, shall implement their decision regarding the affected archaeological site, subject to stipulation III.B. In reaching their decision, the agencies will take the collective decision of the Tribes into account.

(4) Unless otherwise agreed to, data recovery shall be designed and carried out to the maximum extent practicable in a manner consistent with the Council's *Recommended Approach for Consultation on Recovery of Significant Information from Archaeological Sites* (64 FR 27085-87, May 18 1999). Recovered material and data shall be managed in accordance with 36 CFR 79, except for any Native American cultural items repatriated to Tribes pursuant to the Native American Graves Protection and Repatriation Act (NAGPRA). The approving agency or agencies shall ensure that a Plan of Action is developed in accordance with 43 CFR 10 for the management of such NAGPRA items, and that Plan of Action is implemented in consultation with the Tribes.

E. Effects on Air and Water Quality. The approving agency or agencies, in concert with the Siskiyou County Air Pollution Control District and the Regional Water Quality Control Board,



shall ensure that the quality of the air and water in the Highlands is protected through the use of appropriate pollution control devices and measures.

F. Effects on Plants and Wildlife. To the extent practicable and in consultation with the Tribes and Coalition, the approving agency or agencies shall ensure that necessary baseline data are collected on plants and wildlife communities subject to possible Project effects. The approving agency or agencies shall ensure that Project operations are designed and carried out to minimize impacts on native plants and wildlife, that disturbed land areas are appropriately revegetated, and that revegetation employs plants selected in consultation with the Tribes and Coalition.

G. Additional Identification. The approving agency or agencies shall ensure that studies already performed to identify locations of cultural significance subject to effect by the Project, including, but not limited to, archaeological sites, the locations of culturally significant plant and wildlife populations, and locations of spiritual importance or traditional cultural practice, and to determine Project effects on such locations, are augmented as necessary to address Project elements not yet subjected to full effects investigation. Such augmented studies shall include places subject to direct and indirect effects by the proposed Project transmission line.

H. Contingencies. The approving agency or agencies shall ensure that Calpine or any successor(s) develop and annually update contingency plans to control unanticipated Project impacts on the natural and cultural environment resulting from such hazards as well pad sump and pipeline leakages, well blowouts, and fire.

I. Decommissioning and Restoration. The approving agency or agencies shall ensure that upon decommissioning of the Project, or upon abandonment of the Project after well testing if such testing reveals no usable resource, all lands affected by Project's existence and operation are restored to a natural condition, in consultation with the Tribes and Coalition.

J. Mitigation Monitoring. The approving agency or agencies shall establish and implement a strict program of mitigation monitoring to ensure that Calpine and any successor in interest complies with the requirements of stipulations II.A through M, and will afford the Tribes, Coalition, and SHPO every opportunity to participate in such monitoring.

K. Reimbursable Fund. The approving agency or agencies shall require Calpine and/or its successor(s) in interest to establish a fund and pay into it amounts sufficient to reimburse the Tribes and the Coalition for their work in implementing stipulations II.A-J of this Agreement, and to assist in the development and implementation of the Program. The fund may be administered by a third party acceptable to the Tribes and Coalition.

L. Reclamation Bonding. The approving agency or agencies shall require Calpine and any successor(s) in interest to post a surety in an amount sufficient to cover all costs associated with implementing the requirements of stipulation II.I of this Agreement, together with the costs of site reclamation, including but not limited to well plugging and abandonment, powerplant and transmission line removal, and site restoration in a manner consistent with the purposes of this agreement. The surety will be specific to this Project and will not be in lieu of the BLM lease

and site license bond requirements under 43 CFR 3214.13. The approving agency or agencies will require that the surety be posted subject to partial or complete forfeiture if the tasks required by the approving agency or agencies under stipulation II.I are not completed within time periods specified by the approving agency or agencies, provided that the approving agency or agencies and Calpine or its successor may agree to an extension of any such time periods, in consultation with the Tribes, subject to stipulation III.B. In the event forfeiture is imminent, the approving agency or agencies will notify Calpine or its successor that the surety is subject to forfeiture, and will allow Calpine or its successor 30 days to respond before taking action to execute forfeiture. The approving agency or agencies will release the surety, in whole or in part, as specific provisions of stipulation II.I are completed to the satisfaction of the approving agency or agencies, in consultation with the Tribes, subject to stipulation III.B.

M. Phasing. In consultation with the SHPO, Tribes, the Coalition, and Calpine, the approving agency or agencies may structure implementation of stipulations II.A through K in phases, providing for only those activities to be undertaken, and only those costs incurred, during the testing phase of the Project that are relevant to that phase, with additional activities to be undertaken and costs incurred if and when a site license is applied for and issued.

### **III. ADMINISTRATIVE STIPULATIONS**

#### **A. Eligibility for Inclusion in the National Register of Historic Places.**

(1) For purposes of the Agreement, the USFS and BLM shall treat the Highlands as a whole as a landscape that is eligible for inclusion as such in the National Register of Historic Places. Individual locations of cultural, spiritual, historical, and archaeological importance within this landscape will be understood to contribute to the landscape's eligibility.

(2) Specific unevaluated locations of possible cultural importance identified during implementation of this Agreement shall be treated as eligible for the National Register, individually or as elements of the Highlands landscape, and shall be subject to the terms of this Agreement.

(3) Questions about eligibility, including questions raised by parties to this Agreement, shall be resolved through consultation among the USFS, BLM, SHPO, Tribes, and the Coalition, or, if not resolvable through such consultation, shall be referred to the Keeper of the National Register pursuant to 36 CFR 800.4(c)(2). In addition, should the Council request such a referral in the absence of an unresolved question, the USFS or BLM shall refer the matter to the Keeper.

(4) Any property determined under this process to be ineligible need not be given further consideration under this agreement, although it may require further consideration under other legal authority.

#### **B. Resolving Objections.**

(1) Should any party to this Agreement object in writing to the USFS and/or BLM regarding any action carried out or proposed by implementation of this Agreement, the USFS and BLM shall consult with the objecting party to address the objection. The USFS and BLM shall determine a reasonable time frame for this consultation. If resolution is not reached through such consultation, the USFS and BLM may employ an independent third-party mediator to assist in resolving the objection, and consult with the mediator about a timeframe for mediation. If the objection is not resolved within a reasonable timeframe, the USFS and BLM shall forward all documentation relevant to the objection to the Council, including their proposed response to the objection. Within 30 days after receipt of all pertinent documentation, the Council shall exercise one of the following options:

- (a) Advise the USFS and BLM that the Council concurs in their proposed response to the objection, whereupon the USFS and BLM will respond to the objection accordingly;
- (b) Provide the USFS and BLM with recommendations, which the USFS and BLM will take into account in reaching a final decision regarding their response to the objection; or
- (c) Notify the USFS and BLM that the objection will be referred for comment pursuant to 36 CFR 800.7(a)(4), and proceed to refer the objection and comment. In this event, the USFS and BLM shall ensure that their agency heads (Chief of the USFS or Secretary of Agriculture, and Director of BLM or the Secretary of the Interior) are prepared to take the resulting comment into account in accordance with 36 CFR 800.7(c)(4) and Section 110(l) of NHPA.

(2) Should the Council not exercise one of the above options within 30 days after receipt of all pertinent documentation, the USFS and BLM may assume the Council's concurrence in their proposed response to the objection.

(3) The USFS and BLM shall take into account any Council recommendation or comment provided in accordance with this stipulation with reference only to the subject of the objection; their responsibilities to carry out all actions under this agreement that are not the subjects of the objection shall remain unchanged.

(4) At any time during implementation of the measures stipulated in this Agreement, should an objection pertaining to this Agreement or the effect of the Project on historic properties be raised by a member of the public, the USFS or BLM shall notify the parties to this Agreement and take the objection into account, consulting with the objector, and, should the objector so request, with any of the parties to this Agreement, to address the objection.

### C. Reviewing Implementation.

(1) On or before May 15th of each year, until the parties to this Agreement agree in writing that its terms have been fulfilled, the USFS and BLM field units shall prepare and provide a succinct progress report to all parties to this Agreement addressing the following topics:

- (a) Progress in developing and implementing the Program called for by stipulation I;
- (b) Progress in implementing the measures required by stipulation II;
- (c) Any problems or unexpected issues encountered during the year; and

(d) Any changes that the USFS or BLM believes should be made in implementation of this Agreement.

(2) The USFS and BLM shall ensure that their annual report is made available for public inspection, and that potentially interested members of the public are made aware of its availability. Interested members of the public are invited to provide comments to the SHPO, Tribes, and Council, as well as to the agencies. In accordance with stipulation III.G, sensitive information will be protected under Section 304 of the NHPA and Section 9 of the Archaeological Resources Protection Act (ARPA).

(3) The Council and the SHPO shall review the annual report and provide comments within 45 days after receipt to the USFS and BLM, and to concurring parties to this Agreement. Concurring parties may review and comment on the annual report at their discretion.

(4) At the request of any party to this Agreement, the USFS and/or BLM shall ensure that a meeting or meetings are held to facilitate review and comment, to resolve questions, or to resolve adverse comments.

#### D. Professional Standards.

(1) All work related to inventory, evaluation, treatment, and management of cultural and historic properties under the terms of this Agreement, shall be carried out or directly supervised by appropriately trained persons who meet the Secretary of the Interior's Professional Qualifications Standards (48 F.R. 44738-44742; 36 CFR 61, Appendix A; and 36 CFR 296.8(a)) for the particular fields of study required by those activities. The USFS and BLM shall ensure that they and/or the Project retain staff or consultants meeting these standards for the purposes of implementing and monitoring the terms of this Agreement. This provision does not apply to cultural assessment work by the Tribes, the Coalition, or most likely descendants, in the implementation of the Agreement.

(2) All studies related to inventory, evaluation, treatment, and management of cultural and historic properties, and, under the terms of this Agreement, shall meet professional standards, as outlined in the National Park Service's *Archeology and Historic Preservation; Secretary of the Interior's Standards and Guidelines* (48 F.R. 44716-44742), The Secretary of the Interior's Standards and Guidelines for Federal Historic Preservation Programs, the Council's Recommended Approach for Consultation on Recovery of Significant Information from Archaeological Sites (64 F.R. 27085-27087), Bulletin 38, as applicable, and guidance provided by the Modoc, Klamath, and Shasta-Trinity National Forests Heritage Program Leaders and Tribal Relations Program Managers. This provision does not apply to cultural assessment work by the Tribes, the Coalition, or most likely descendants, in the implementation of the Agreement.

#### E. Standards for Technical Documents.

The USFS and BLM shall ensure that all technical documents prepared to satisfy the terms of this Agreement are responsive to contemporary professional standards, including the Secretary of



the Interior's Standards for Documenting Historic Properties (48 F.R. 44728-44737), the Secretary of the Interior's *Formal Standards for Final Reports of Data Recovery Programs* (42 F.R. 5377-5379), the SHPO's *Archaeological Resource Management Reports (ARMR): Recommended Contents and Format* (1989), and guidance provided by the Modoc, Klamath, and Shasta-Trinity National Forests Heritage Program Leaders and Tribal Relations Program Managers.

#### F. Curation and Disposition of Cultural Materials and Human Remains.

(1) The USFS and BLM shall ensure that all records and materials resulting from identification and management efforts for the Program are curated pursuant to 36 CFR 79 and the provisions of the NAGPRA, 43 CFR 10, as applicable.

(2) The USFS and BLM shall ensure that any human remains and other NAGPRA items encountered through the Program are treated with due respect, and according to the provisions of NAGPRA, its implementing regulations 43 CFR 10, and appropriate State law, local ordinances, and federal policy.

#### G. Confidentiality.

(1) The USFS and BLM shall ensure that all sensitive information, as defined in Section 9 of the ARPA, Section 304 of the NHPA, and NAGPRA, is managed in such a way that historic properties, traditional cultural values, sacred objects, and human remains are not compromised, to the fullest extent available under law.

(2) Signatory and concurring parties to this Agreement shall safeguard information about the nature and location of archaeological, historic, and traditional cultural properties, and not reveal that information to any additional parties, pursuant to Section 304 of the NHPA and Section 9 of the ARPA, without the express written permission of the USFS and the BLM.

#### H. Amendment and Termination.

Based on, but not necessarily limited to, the review in stipulation III.C, the signatory parties to this Agreement shall determine whether the Agreement shall continue in force, be amended, or be terminated.

(1) Amendment. If any party believes that this Agreement should be amended, that party may at any time propose amendments to the other parties, whereupon these parties will consult to consider the amendments. This Agreement may be amended only upon the written signature of the signatory parties.

(2) Termination. This Agreement may be terminated only upon the written signature of the signatory parties. Termination of this Agreement shall proceed in accordance with the applicable requirements of 36 CFR 800.

(3) Automatic Termination. If the terms of this Agreement have not been implemented by May 15, 2005, the Agreement shall be considered null and void, unless extended by written agreement of the signatory parties to this Agreement. In such event, the USFS and BLM shall so notify all other parties to this Agreement, and, if they choose to continue considering the Project, the USFS and BLM shall reinitiate review of the Project in accordance with 36 CFR Part 800.

I. Fiscal Responsibility. Nothing in this Agreement shall bind the agencies to expend funds which are not appropriated by Congress.

#### IV. EXECUTION OF THIS AGREEMENT

This Agreement may be executed in counterparts, with a separate page for each signatory party, and the USFS and BLM shall ensure that each party is provided with a copy of the fully executed Agreement. This Agreement will become effective on the date that the USFS and BLM receive the last signature from a signatory party.

**FOURMILE HILL GEOTHERMAL DEVELOPMENT PROJECT AGREEMENT  
DOCUMENT**

Execution of this Agreement by the USFS, the BLM, the SHPO, and the Council, and implementation of its terms, evidence that the USFS and BLM have afforded the Council an opportunity to comment on the Project and its effects on historic properties, and that the USFS and BLM have taken into account the effects of the Project on historic properties.

**SIGNATORY PARTY:**

U.S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE

By: *Bertha C. Dillam* Date: *May 18, 2000*  
*Associate Regional Forester*

**FOURMILE HILL GEOTHERMAL DEVELOPMENT PROJECT AGREEMENT  
DOCUMENT**

Execution of this Agreement by the USFS, the BLM, the SHPO, and the Council, and implementation of its terms, evidence that the USFS and BLM have afforded the Council an opportunity to comment on the Project and its effects on historic properties, and that the USFS and BLM have taken into account the effects of the Project on historic properties.

**SIGNATORY PARTY:**

U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT

By: Al Wright Date: 5/16/00

**FOURMILE HILL GEOTHERMAL DEVELOPMENT PROJECT AGREEMENT  
DOCUMENT**

Execution of this Agreement by the USFS, the BLM, the SHPO, and the Council, and implementation of its terms, evidence that the USFS and BLM have afforded the Council an opportunity to comment on the Project and its effects on historic properties, and that the USFS and BLM have taken into account the effects of the Project on historic properties.

**SIGNATORY PARTY:**

CALIFORNIA STATE HISTORIC PRESERVATION OFFICER

By: Manuel Almeyda Date: 5/18/00





**FOURMILE HILL GEOTHERMAL DEVELOPMENT PROJECT AGREEMENT  
DOCUMENT**

Execution of this Agreement by the USFS, the BLM, the SHPO, and the Council, and implementation of its terms, evidence that the USFS and BLM have afforded the Council an opportunity to comment on the Project and its effects on historic properties, and that the USFS and BLM have taken into account the effects of the Project on historic properties.

**SIGNATORY PARTY:**

ADVISORY COUNCIL ON HISTORIC PRESERVATION

By: John M. Stuber Date: 5/24/00

**APPENDIX D:  
INTERIM GUIDELINES FOR ADDRESSING  
TRADITIONAL CULTURAL VALUES OF  
THE MEDICINE LAKE HIGHLANDS  
RELATIVE TO ENVIRONMENTAL  
ANALYSIS AND SECTION 106 NHPA  
DETERMINATION OF EFFECT**

## Appendix D

Proposed Interim Guidelines for  
**Addressing Traditional Cultural Values of the  
Medicine Lake Highlands Relative to Environmental Analysis**

**And Section 106 NHPA Determination of Effect**

Revised July 17, 2002

per April 9, 2002 consultation meeting with Pit River Tribe and  
May 20, 2002 consultation meeting with Klamath Tribes

1. **Consult with Tribe prior to scoping to identify level of project risk to cultural values. If the project is of concern to the Tribes go through steps 2-7. If the project is not a concern follow CASHPO/FS R5 Programmatic Agreement. Steps for consultation;**
  - **Notify Tribal Chairman by letter, with a cc to the Culture and Heritage staff, about the project proposal including a request for tribal input and consultation. The agency will follow up the letter with a phone call, to ensure contact, especially if the proposal appears to pose some level of risk to known or potential cultural values. If the Tribe does not respond within 30 days from the date of the notification letter and/or follow up calls, the agency will assume that the Tribe has no concerns with the project.**
  - **Tribe responds to letter, either by phone or letter, with information describing how they would like to participate in review of the proposal (example, meetings, field trips, not at all). The Tribes' response should also include their initial level of interest or concern for the project as proposed.**
  - **The Agency coordinates the project review meeting and documents the results of the meeting in a formal *letter of closure* to the Tribe. This letter will restate the project proposal (and association prescriptions), summarize the results of initial consultation including issues, concerns, opportunities, agreements for mitigation, level of tribal participation in the environmental analysis process, alternative development and any action items identified during project review.**
  - **The Tribe may use this *letter of closure* as documentation of their expectations for participation in the environmental analysis process and as a tool for formalizing their concurrence or non-concurrence of the project. Written tribal response to the letter of closure might include responses such as "no follow up needed", concur as long as mitigation/monitoring followed, and/or the response could address any other contingencies.**
  - **If the Tribe does not respond to the agency's *letter of closure* within 30 days from the date of the letter, the agency will assume project concurrence.**



2. Consult with Tribes to identify sensitive cultural places within the project area and their associated values, or desired conditions, for, but not limited to, privacy, setting, view shed, current uses, etc. Use section IA (a-i and k) of MOA as a guideline to assist in defining cultural values where appropriate for the project area and Area of Potential Effect.
3. During analysis, and within the EA document, recognize the cultural significance of the Medicine Lake Highlands to the Pit River, Klamath (and Shasta) Tribes in the Purpose and Need Statement. In addition to the project purpose and need statement, also state need to address and protect cultural values and identify opportunities for enhancement of cultural values through project design. State intent to work in spirit of MOA. Cite Section III (1) of MOA that says: “For purposes of the Agreement, the USFS and BLM shall treat the Highlands as a whole as a landscape that is eligible for inclusion as such in the National Register of Historic Places. Individual locations of cultural, spiritual, historical and archaeological importance within this landscape will be understood to contribute to the landscape’s eligibility.”
4. *Use the Keeper of the National Register’s Determination of Eligibility recommendations as a reference and guide during project analysis, site evaluation and while designing inventory/research strategy (Apply only those that are relevant to the values and sites types located within the projects’ APE).*
5. Work with the Tribes to design alternatives to avoid or minimize impacts to traditional cultural values and archaeological sites. Emphasize treatments where management for cultural values are compatible with other resource management goals identified in the purpose and need statement. Identify opportunities to enhance or restore cultural values.
6. Display effects to cultural values for those values identified for each alternative as per NEPA and NHPA. Display actions that address cultural issues.
7. Keeping confidentiality in mind, for the preferred/selected alternative, generally display how tribal input and values were considered in the decision.
8. Exclude all FOIA exempt information from the administrative record/analysis file as per NHPA section 304 and ARPA section 9.

## **PROJECT IMPLEMENTATION GUIDELINES**

Tribal and Forest Service staff and District Rangers have identified a need for two types of monitoring for the purpose of: 1) Cultural site protection during project layout and implementation, and 2) Evaluating the success of project prescriptions relative to their effectiveness in the protection and/or enhancement of cultural values and traditional resources.

1) In certain situations, archaeologists and tribal monitors may need to work with contracting officers and visit sensitive sites located near areas of operations to ensure that

**archaeological and traditional cultural values are not inadvertently damaged by ground disturbing activities. Such sites will be designated as “Areas to Protect”.**

**2) After completion, the project will be monitored to evaluate whether or not prescriptions or project design objectives were met. The Forest Service and Tribe will determine where treatments met objectives and where they did not. Based on what is learned, future treatments may be designed accordingly.**

**Note: The FS and Tribes have identified a possible need to create a Participating Agreement that will emphasize the mutual benefit of working as partners towards the protection of traditional cultural values of the Medicine Lake Highlands. Acknowledging that federal funds are limited, the Forest Service and Tribes have identified a need to work in partnership to research and acquire external grant opportunities.**

**APPENDIX E:  
MEDICINE LAKE AREA GEOPHYSICAL  
STUDIES CONSULTATION REPORT**

# **Medicine Lake Area Geophysical Studies Consultation Report**

September 18, 2008

Dorothea J Theodoratus, Ph.D., and Kathleen McBride, M.A.

The purpose of this report is to document tribal consultation for the preparation of an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA). The assessment will document the potential environmental effects of a proposed project to conduct geophysical surveys on Bureau of Land Management (BLM) issued leases in the Glass Mountain Known Geothermal Resources Area (KGRA) located in the Medicine Lake Highlands, in portions of the Modoc, Klamath, and Shasta-Trinity National forests, Siskiyou and Modoc counties, California. The BLM is the lead agency under NEPA for this federal undertaking. The proposed project is located within the lands of traditional use by the Pit River and Klamath (Modoc) tribes.

Preparations for a tribal consultation meeting consisted of discussions of the proposed project with representatives of MHA/RMT, the firm preparing the Environmental Assessment. Consultation also was held with the Tribal Government Relations Coordinator for this National Forest area. These consultations resulted in the provision of previously written materials concerning the cultural resources and tribal consultations related to geothermal development in the Medicine Lake Highlands (Deur 2003; Historic Properties Management Program [HPMP] 2007). In addition to materials provided, a comprehensive ethnographic report on the area, prompted by a previous geothermal development proposal in the same area, was consulted for background material (Theodoratus et al. 1998).

Contact with the Pit River Tribal Chair was initiated through a series of phone calls that resulted in a meeting scheduled for September 12, 2008 in Burney, Shasta County. Following Tribal protocol a "Request to be on Agenda" was submitted on September 4, 2008 and the subject was added to the agenda for the September 12<sup>th</sup> Tribal Council meeting at 3:10 pm.

At the September 12<sup>th</sup> meeting, the researchers were introduced to the nine Council members present by the Tribal Environmental Protection Agency (EPA) Coordinator. The purpose of the meeting was explained and the project description presented. This was accompanied by the distribution of the following to each Council Member: a map showing the proposed 120 exploration sites; a copy of the BLM letter soliciting comments from "Interested Parties" dated June 12<sup>th</sup> 2008; and a Calpine "Notice of Intent" containing the project plan details.

The researchers' narrative description of the proposed project was quickly interrupted by comments from Council members expressing their obvious frustration with agencies' continued attempts to permit geothermal exploration and development activities in their traditionally sacred territory. Several such objections to past and present exploration ensued. It was pointed out that the Tribe has repeatedly stated their objections to these activities over the years and yet, their comments though unchanged, continue to be solicited. An attempt was made to discuss the process and the need to, once again, go



through the process for this proposed project. The EPA Coordinator reminded the Council that the Klamath Tribes have refused to engage in any further discussion with agencies about geothermal activities and they are adamantly opposed to these projects. This was followed by additional comments from the Council opposing the project and reiterating their heritage ties to, and continued use of, the lands under consideration. Their objections indicated that this kind of use, geothermal exploration, would be incompatible with the Native spiritual use that is ongoing in the Highlands. In their view, exploration is a necessary precursor to development.

The Tribal Chair remarked that, in spite of the fact that the BLM continues to bring people to the table to do everything in their power to change the Tribe's position, that position has remained steadfast over many years and into the next generation of members, who are now joining their elders in their opposition to geothermal exploration and development in the Medicine Lake Highlands. The process was again discussed and it was reiterated that each project must be considered individually. It was agreed that everything has been said, so the question arose regarding what action might be taken by the Tribe.

It was suggested that agency staff or their representatives do not qualify as a sufficient level of authority for government to government consultation. In response to the view expressed, it was decided that a formal statement of opposition in the form of an official Tribal Resolution be drafted and sent to the BLM. In addition, a Tribal delegation to Washington, D. C. was proposed; however, a previous delegate noted that the present administration has not been receptive to the Tribe's prior attempts to consult. Consequently, rather than pursuing further consultation with the Department of Interior in Washington, this delegation intends to seek an audience with congressional representatives.

The Tribal Chair and the Council want to go on record in opposition to this proposed project and plan to draft a Resolution of Opposition to that effect. There appears to be no willingness to discuss potential mitigation measures for adverse effects to their Traditional Cultural Property District. The Tribe stated that they will be sending a letter stating their opposition to the project because of its perceived violation of the sanctity and traditional cultural values of the Medicine Lake Highlands. This perspective is consistent with views previously expressed to BLM staff in two meetings with the Tribal Council (June 5, 2008, August 14, 2008).

It is the Tribe's expressed perception, that the adverse effect of the proposed project would create a substantial adverse change in the qualities that constitute the property's value as a Traditional Cultural Property District. The Historic Properties Management Program developed by the US Department of Agriculture, Forest Service, and the US Department of Interior, Bureau of Land Management, in consultation with the Tribes and the Advisory Council on Historic Preservation supports this conclusion of adverse effect (see Table 3-2, Potential Effects to Cultural Values by Land Use – Tribal Perspective, 2007:45).

## References Cited

Burke, Tim, Field Manager

2008 Documentation of Tribal Government Consultation and Coordination, Bureau of Land Management, Alturas Field Office. Pit River Tribal Council, Meeting June 5, 2008. Alturas, CA.

2008 Documentation of Tribal Government Consultation and Coordination, Bureau of Land Management, Alturas Field Office. Pit River Tribal Council, Meeting August 14, 2008. Alturas, CA.

Deur, Douglas, Ph.D.

2003 Medicine Lake Highlands, Historical Properties Management Planning, Ethnographic Inventory. Report presented to Amy Gowan, Klamath National Forest, CA.

Theodoratus, Dorothea, Ph.D.; Thomas L. Jackson, Ph.D., and Geri Emberson, M.A.

1998 Consultations with the Pit River Tribe, the Klamath Tribes, and the Shasta Tribe for the Fourmile Hill Geothermal Development Project, Siskiyou and Modoc Counties, CA. Submitted to MHA Environmental Consulting, Inc. San Mateo, CA.

1998 Medicine Lake Highland and Timber Mountain Ethnographic Report for the Fourmile Hill Geothermal Development Project, Siskiyou and Modoc Counties, CA. Submitted to MHA Environmental Consulting, Inc. San Mateo, CA.

US Department of Agriculture, Forest Service

2007 The Medicine Lake Highlands Historic Properties Management Program: Including a Cultural Assessment and Guidelines for Management, August 24, 2007. Developed by the USDA, Forest Service (Modoc, Klamath, and Shasta-Trinity National Forests), and the US Department of Interior, Bureau of Land Management (Alturas Field Unit).

# **APPENDIX F: SENSITIVE PLANTS**

**FEDERALLY LISTED AND SENSITIVE PLANT SPECIES**  
**Section 7 ESA, FSM 2670**  
**KLAMATH NATIONAL FOREST**

**October 2006**

(This list supersedes all similar lists bearing earlier dates. It is subject to change as new information becomes available. Procedures for documenting changes are identified in FSH 2609.25 section 1.32.)

**Federally listed as Endangered (E), Threatened (T), or Proposed (P)**

	<b>Species</b>	<b>Code</b>
*	<i>Arabis macdonaldiana</i> Eastw. (E)	ARMC
***+	<i>Astragalus applegatei</i> Peck (E)	ASAP
***+	<i>Fritillaria gentneri</i> Gilkey (E)	FRGE
*	<i>Phlox hirsuta</i> E.Nelson (E)	PHH17

**Region 5 listed as Sensitive that may occur on the Klamath National Forest**

	<b>Vascular Plant Species</b>	<b>Code</b>
+	<i>Botrychium crenulatum</i> W. H. Wagner	BOCR
+	<i>Botrychium lunaria</i> (L.) Sw.	BOLU
+	<i>Botrychium minganense</i> Victorin	BOMI
+	<i>Botrychium montanum</i> W. H. Wagner	BOMO
H	<i>Botrychium pinnatum</i> St. John	BOPI
+	<i>Botrychium virginianum</i> (L.) Swartz	BOVI
	<i>Calochortus greenei</i> Wats.	CAGR
C**	<i>Calochortus persistens</i> Ownbey	CAPE
	<i>Campanula wilkinsiana</i> Greene	CAWI8
	<i>Chaenactis suffrutescens</i> A. Gray	CHSU
+	<i>Collomia larsenii</i> (Gray) Payson	COLA8
	<i>Cypripedium fasciculatum</i> Wats.	CYFA
	<i>Cypripedium montanum</i> Lindl.	CYMO2
	<i>Draba carnosula</i> O. E. Schulz	DRCA6
	<i>Epilobium oregonum</i> Greene	EPOR
*	<i>Eriogonum alpinum</i> Engelm.	ERAL6
	<i>Eriogonum hirtellum</i> J.T. Howell and Bacig.	ERHI7
	<i>Eriogonum ursinum</i> S. Watson var. <i>erubescens</i> Reveal & J. D. Knorr	ERURE
+	<i>Erythronium citrinum</i> Wats. var. <i>roderickii</i> Shevock & Allen	ERCIR
+	<i>Eucephalis vialis</i> Bradshaw	EUVI8
+	<i>Frasera umpquaensis</i> M.E. Peck & Applegate	FRUM2
	<i>Horkelia hendersonii</i> J. Howell	HOHE2
	<i>Ivesia pickeringii</i> Torr. ex Gray	IVPI
	<i>Lupinus lepidus</i> Dougl. ex Lindl. var. <i>ashlandensis</i> (B.J.Cox) Isley	LULEA
H	<i>Mimulus evanescens</i> Meinke	MIEV
	<i>Minuartia stolonifera</i> Nelson & Nelson	MIST9
+	<i>Parnassia cirrata</i> Piper var. <i>intermedia</i> (Rydb.) P.K. Holmgren & N.H. Holmgren	PACII
	<i>Pedicularis howellii</i> Gray	PEHO



	<i>Phacelia cookei</i> Const. & Heckard	PHCO20
	<i>Phacelia greenei</i> J. Howell	PHGR2
	<i>Phacelia inundata</i> J. Howell	PHIN3
+	<i>Polemonium chartaceum</i> H. Mason	POCH3
	<i>Raillardella pringlei</i> Greene	RAPR
	<i>Rorippa columbiae</i> (Robinson) Howell	ROCO3
	<i>Smilax jamesii</i> G. Wallace	SMJA
	<i>Tauschia howellii</i> (Coul. & Rose) Macbr.	TAHO2
	<i>Thermopsis robusta</i> J. Howell	THRO4

#### **Fungi Species**

#### **Code**

	<i>Boletus pulcherrimus</i> Thiers & Halling	BOPU4
	<i>Cudonia monticola</i> Mains	CUMO2
	<i>Dendrocollybia racemosa</i> (pers.: Fr.) Peterson & Redhead	DERA5
	<i>Phaeocollybia olivacea</i> A.H.Smith	PHOL
	<i>Sowerbyella rhenana</i> (Fuckel) J.Moravec	SORH
	<i>Tricholomopsis fulvescens</i> A.H.Smith	TRFU3

#### **Bryophyte Species**

#### **Code**

+	<i>Buxbaumia viridis</i> (DC.) Moug. & Nestl.	BUVI2
	<i>Fissidens aphelotaxifolius</i> Pursell	FIAP
	<i>Helodium blandowii</i> (Web. & Mohr) Warnst.	HEBL2
	<i>Meesia triquetra</i> Ångstr.	METR70
	<i>Meesia uliginosa</i> Hedw	MEUL70
	<i>Mielichhoferia elongata</i> (Hoppe & Hornsch. Ex Hook) Nees & Hornsch. In Nees et. Al	MIEL5
	<i>Ptilidium californicum</i> (Aust.) Underw.	PTCA5

#### **Lichen Species**

#### **Code**

+	<i>Hydrothyria venosa</i> J. L. Russell	HYVE7
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- \* Officially listed as Endangered by the State of California.
- \*\* Officially listed as Rare by the State of California.
- \*\*\* Officially listed as Endangered by the State of Oregon
- C Federally listed Candidate species
- + Suspected to occur, but not currently documented.
- H Historic occurrence, not currently documented

Sensitive & endemic plant species known or suspected to occur on the west side of the Shasta-Trinity National Forest, including Big Bar, Hayfork, Weaverville, & Yolla Bolla Ranger Districts, 10/01/2007. Species eliminated from further consideration in this project BE are indicated and explained in table.

Species	Habitat & Rationale for Eliminating From Consideration	Potential for Presence in Project Area
<b>Vascular Plants</b>		
<i>Anisocarpus scabrida</i> (= <i>Raillardiopsis scabrida</i> ) rough raillardella G2G3 S2S3	Rocky, open subalpine slopes. 5500-7500 feet elev. North Coast Ranges & southern Cascades.	
<i>Botrychium</i> subg. <i>Botrychium</i> and subg. <i>Sceptridium</i> (except <i>B. multifidum</i> ) moonwort, grapefern G3/G4/G5 S1/S2	Riparian edges in mid to high elevation forest. Fields, shrubby slopes, shady forests; riparian areas. 1000-6000 feet elev.	
<i>Campanula wilkinsiana</i> Wilkins' harebell G2 S2.2	Streambanks & springs in red fir and subalpine forests; 5500-8600 feet elev.	
<i>Chaenactis suffrutescens</i> Shasta chaenactis G3 S3.2	Rocky open slopes, cobbly river terraces; on ultramafic soils or glacial till w/ ultramafics included. 2600-6900 feet elev. Eastern Klamath Ranges of CA.	
<i>Clarkia borealis</i> ssp. <i>borealis</i> northern clarkia G3T2 S2.3	Foothill woodlands and forest margins. 1300-2600 feet. Eastern Trinity and W. Shasta Co.	
<i>Cypripedium fasciculatum</i> Brownie lady's slipper G4 S3.2	Mixed conifer or oak forests on a variety of soil types, often but not always associated with streams; 1300-6000 feet elev. Widespread but sporadic.	
<i>Cypripedium montanum</i> mountain lady's slipper G4 S4	Mixed conifer or oak forests on a variety of soil types, often but not always associated with streams; 1300-6000 feet elev. Widespread but sporadic.	
<i>Draba carnosula</i> Mt. Eddy draba G2 S2.2	High elevation ridges and summits on rocky ultramafic soils. 6000 to 9000 feet.	
<i>Epilobium oregonum</i> Oregon willow herb G2 S2.2	Wet, gently sloping stream banks, meadows, & bogs, generally on ultramafic soil. 500-7800 feet elev. Klamath Ranges of CA & OR.	
<i>Eriastrum tracyi</i> Tracy's woolly-stars G3 S3.2	Dry gravelly to loamy soils on flats and benches; closed cone pine forests or chaparral. 1000 to 4300 feet elev. North Coast Ranges	

Species	Habitat & Rationale for Eliminating From Consideration	Potential for Presence in Project Area
<i>Eriogonum ursinum</i> var. <i>erubescens</i> blushing wild buckwheat G3G4T2 S2.3	Rocky openings on open ridgelines in the Klamath Range. 5300-6200 feet.	
<i>Erythronium citrinum</i> var. <i>roderickii</i> Scott Mountain fawn lily G4T1 S1.3	Mixed conifer forest on ultramafic or granitic soils. 2900-4000 feet elev. Trinity & Scott Mountains.	
<i>Frasera umpquaensis</i> (= <i>Swertia fastigiata</i> ) Umpqua green gentian -----	Cool, moist Douglas-fir/white fir forest margins or openings. 5000-6000 feet elev. South Fork Mountain, Trinity Co., & SW OR.	
<i>Harmonia doris-nilesiae</i> Niles' madia G2 S1.1	Rocky ultramafic ridgetops & slopes with Jeffrey pine, gray pine, & shrubs. 2100-5500 feet elev. Rattlesnake Creek Terrane (M261Au) of southern Klamath Ranges.	
<i>Harmonia stebbinsii</i> Stebbins' madia G2 S2.2	Rocky ultramafic semi-barrens with Jeffrey pine, gray pine, & shrubs. 2100-6000 feet elev. Southern Klamath Ranges & Inner N Coast Ranges.	
<i>Iliamna bakeri</i> Baker's globe mallow G4 S3.2	Chaparral, pine or mixed conifer/oak forest, juniper woodland; on rocky soil, 3800-6800 ft. elev. Scott Mtn., Cascades & Modoc Plateau.	
<i>Iliamna latibracteata</i> California globe mallow G3 S2.2	Conifer forest and streamsides in the Klamath Range. 1600 – 6600 feet. South Fork Mountain.	
<i>Ivesia pickeringii</i> Pickering's ivesia G2 S2.2	Ephemeral drainages & seasonally wet grassy slopes in mixed conifer forest, on ultramafic soils. 2500-4500 feet elev. Scott Mountain & Trinity Mtns.	
<i>Leptosiphon nuttallii</i> ssp. <i>howellii</i> (= <i>Linanthus n. ssp. h.</i> ) Tedoc Mountain linanthus G5T1 S1.2	Jeffrey pine/incense cedar forest, usually on ultramafic soil. 4000-5000 feet elev. Localized around the base of Tedoc Mountain, Tehama Co.	
<i>Minuartia rosei</i> Peanut sandwort G3 S3.2	Gravelly serpentine barrens & openings in Jeffrey pine/mixed conifer forest. 2500-5800 feet elev. Rattlesnake Creek Terrane (M261Au) of southern Klamath Ranges.	
<i>Minuartia stolonifera</i> Scott Mountain sandwort G1 S1.3	Rocky slopes on ultramafic soils; montane mixed conifer forest. 4100-5300 feet elev. Scott Mountain.	
<i>Montia howellii</i>	Vernally, wet sites, often on compacted soil.	

Species	Habitat & Rationale for Eliminating From Consideration	Potential for Presence in Project Area
Howell's montia G3G4 S1.2	Below 1500 feet. Coastal and Klamath Mountains.	
<i>Parnassia cirrata</i> var. <i>intermedia</i> fringed grass-of-parnassus	Wet areas, lake edges in ultramafic soils. Below 9600 feet Klamath Ranges	
<i>Penstemon filiformis</i> thread-leaf beardtongue G3 S3.3	Rocky openings in lower montane conifer forest on ultramafic soils. 2000-6000 feet elev. Trinity Mountains.	
<i>Phacelia greenei</i> Scott Valley phacelia G2 S2.2	Gravelly serpentinized slopes & forest openings. 5000-7000 feet elev. Scott Mountain.	
<i>Raillardella pringlei</i> showy raillardella G2 S2.2	Wet ultramafic meadows, seeps and streambanks. Elev. 4000-7500 feet. Klamath Ranges	
<i>Sedum paradisum</i> Canyon Creek stonecrop G4G5T1 S1.2	Rock outcrops in forest or woodland openings. 960-6500 feet elev. Southern Klamath Ranges of CA	
<i>Smilax jamesii</i> English Peak greenbriar G2G3 S2. 3	Shaded riparian habitat above 2900 feet. Klamath & Cascade Ranges.	
<b>Forest Plan Endemics</b>		
<i>Ericameria ophitidis</i> (= <i>Haplopappus ophitidis</i> ) serpentine goldenbush G3 S3.3	Serpentine semi-barrens or openings in Jeffrey pine-incense cedar woodland. 2600-5600 feet elev. Rattlesnake Creek Terrane (M261Au) & Chancelulla Peaks of the southern Klamath Ranges	
<i>Eriogonum libertini</i> Dubakella Mountain buckwheat G3 S3.2	Openings in Jeffrey pine-incense cedar woodland or chaparral, always on ultramafic soils. 2500-5500 feet elev. Rattlesnake Creek Terrane (M261Au) & Chancelulla Peaks of the southern Klamath Ranges	
<i>Arnica venosa</i> veiny arnica G3 S3.2	Mixed conifer or conifer/oak forest, especially on ridgetops & old road cuts. 2000-5200 feet elev. Trinity & Shasta Cos.	
<b>Bryophytes-Sensitive</b>		
<i>Buxbaumia viridis</i> bug-on-a-stick (moss) G3G4 ----	Large diameter, advanced decay logs in riparian habitat in conifer forest. Low elevation to alpine.	
<i>Mielichhoferia elongata</i> copper moss G4?T4?	Exposed soil or rock containing copper minerals (in this area). Roadcuts. All elevations.	



Species	Habitat & Rationale for Eliminating From Consideration	Potential for Presence in Project Area
<i>Ptilidium californicum</i> Pacific fuzzwort G3G4	Large-diameter Douglas-fir or white fir, 3000 to 5000 feet elev.	
<b>Lichens-Sensitive</b>		
<i>Peltigera hydrothyria</i> aquatic lichen G3G5	Rocks in cool water, perennial, mountain streams.	
<i>Sulcaria badia</i> bay horsehair lichen G3 S2S3.2	Coastally influenced, open white oak grassland or mature Douglas-oak forest with a black oak component, growing in tree canopy. Below 1800 feet in western Trinity County.	
<b>Fungi -Sensitive</b>		
<i>Boletus pulcherrimus</i> red-pored bolete G2G3 S2	Mature or late-seral Douglas-fir forest with hardwoods	
<i>Cudonia monticola</i> G3 S1	On spruce needle mats and coniferous debris in perennially moist, shady late-seral forest. All elevations	
<i>Dendrocollybia racemosa</i> branched collybia G2G3 S1S2	Nutrient rich leaf mulch or decaying fungi in conifer forest; all elevations	
<i>Phaeocollybia olivacea</i> olive phaeocollybia G2 S2	Mixed conifer forest containing oak or pine. All elevations.	
<i>Sowerbyella rhenana</i> orange-peel fungus G3G4 S2	Duff of moist, undisturbed, older conifer forest. All elevations.	

**Sensitive Plant species known or potentially occurring on the Shasta National Forest including Shasta Lake, Mt. Shasta and McCloud Ranger Districts as of October 1, 2006**

Scientific Name (Common Name)	General Habitat Description	Potential to Occur Y/N	Reason for Non-consideration for Project Area
<i>Anisocarpus scabridus</i> Scabrid alpine tarplant	Rocky, open subalpine slopes; elevation 5500-7500 feet.		
<i>Boletus pulcherrimus</i> Red-pore bolete fungi	Occurs in humus in association with the roots of <i>Pseudotsuga menziesii</i> and <i>Abies grandis</i> in coastal forests.		
<i>Botrychium crenulatum</i> Scalloped moonwort	Bogs and fens, lower montane coniferous forest, meadows and seeps, marshes and swamps (freshwater); elevation 4900-10,760 feet. Known to occur in SE Shasta County.		
<i>Botrychium minganense</i> Mingan moonwort	Lower montane coniferous forest (mesic); elevation 4900-6000; known to occur in SE Shasta County		
<i>Botrychium pinnatum</i> northwestern moonwort	Upper montane conifer (mesic) and meadows and seeps; elevation 5800-6700 feet. Occurs in Siskiyou County		
<i>Botrychium Virginian</i> Rattlesnake fern	Bogs, fens, meadows, seeps, riparian forest and lower montane coniferous forest (mesic); elevation 2400-4260 feet. Occurs in Siskiyou County and Big Bend area of Shasta County.		
<i>Buxbaumia viridis</i> Green bug-on-a-stick Bryophyte	Large diameter, advanced decay logs in riparian habitat in conifer forest. Low elevation to alpine.		

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Scientific Name (Common Name)	General Habitat Description	Potential to Occur Y/N	Reason for Non-consideration for Project Area
<i>Calochortus greenei</i> Greene's mariposa lily	Cismontane woodland, meadows and seeps, pinyon and juniper woodland, upper montane coniferous forest/ volcanic; elevation 3400-6200 feet. Modoc and Siskiyou Counties.		
<i>Calochortus longebarbatus</i> var. Long-haired star tulip	Great basin scrub, lower montane coniferous forest (opening and drainages), meadows and seeps, vernal pools/heavy clay soils, mesic; elevation 3300-6200 feet. Occurs on the east side of the McCloud Ranger District in Siskiyou and Shasta Counties.		
<i>Calystegia atriplicifolia</i> ssp. <i>buttensis</i> Butte County morning glory	Lower montane coniferous forest, rocky and Chaparral; elevation 1970-4920 feet.		
<i>Campamula shetteri</i> Castle Crags hairbell	Granite and diorite cliffs; north and northwest exposures, Castle Crags endemic; elevation 3600-6000 feet.		
<i>Campamula wilkinsiana</i> Wilkin's hairbell	Stream banks and springs in red fir and subalpine forests; elevation 5500- 8600 feet.		
<i>Chaenactis suffrutescens</i> Shasta Chaenactis	Rocky open slopes, cobbley river terraces; on ultramafic soils or glacial till w. ultramafics included. Elevation 2600-6900 feet. Eastern Klamath Ranges of CA.		

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Scientific Name (Common Name)	General Habitat Description	Potential to Occur Y/N	Reason for Non-consideration for Project Area
<i>Clarkia borealis</i> ssp. <i>borealis</i> northern clarkia	Siskiyou and Trinity Counties. Chaparral, cismontane woodland, lower montane coniferous forest; Likes road cuts; elevation 1300-4400 feet; Shasta and Trinity Counties.		
<i>Collomia larsenii</i> <i>talus collomia</i>	Alpine boulder and rock field, closed-cone coniferous forest, subalpine coniferous forest/ volcanic talus; elevation 7250-11500 feet; Shasta and Siskiyou Counties.		
<i>Cordylanthus tenuis</i> ssp <i>pallescens</i> <i>pallid bird's beak</i>	Lightly disturbed openings in ponderosa pine forest; gravelly volcanic or ultramafic soils; elevation 3600-5200 feet. Only known from Mt. Shasta area.		
<i>Cudonia monticola</i> No common name	Spruce needles and coniferous debris Generally coastal		
<i>Cypripedium fasciculatum</i> clustered ladies slipper	Lower montane coniferous forest and north Coast coniferous forest/ usually serpentine seeps and streambanks; elevation 980-7990 feet.		
<i>Cypripedium montanum</i> mountain lady's slipper	Broadleaf upland forest, cismontane woodland, lower montane coniferous forest and North Coast coniferous forest; elevation 600-7300 feet.		
<i>Dendrocollybia racemosa</i> branched collybia	Small groups or colonies on old decayed or blackened mushrooms or occasionally in coniferous duff; western Trinity and		



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Scientific Name (Common Name)	General Habitat Description	Potential to Occur Y/N	Reason for Non-consideration for Project Area
<i>Draba carnosula</i> Mt. Eddy draba	Siskiyou Cos. (Coast & Klamath ranges) Subalpine coniferous forest, upper montane coniferous forest/ serpentinite, rocky; elevation 6350-9840 feet. Del Norte, Siskiyou & Trinity Cos.		
<i>Epilobium oregonum</i> Oregon willowherb	Wet, gently sloping stream banks, meadows & bogs, generally on ultramafic soils; 500-7800 feet. Klamath Ranges.		
<i>Eriastrum tracyi</i> Brandegee's woolly-star	Chaparral, cismontane woodland/ volcanic; elevation 1000-3380 feet. SE Shasta and SW Trinity Cos.		
<i>Eriogonum alpinum</i> Trinity buckwheat.	Exposed, rocky serpentine ridges & slopes; elevation 6700- 9000 feet. Siskiyou & Trinity Cos.		
<i>Eriogonum ursinum</i> var. <i>erubescens</i> blushing wild buckwheat	Rocky openings on open ridgelines; elevation 5300-6200 feet. Known from the eastern Scott Bar Mtn., Siskiyou Co. & Trinity Mtn. Trinity co.		
<i>Erythronium citrinum</i> var. <i>roderickii</i> Scott Mountain fawn lily	Mixed conifer forest on ultramafic or granitic soils. 900-4000 feet elevation. Trinity & Scott Mountains		
<i>Frasera umpquaensis</i> Umpqua green-gentian	Chaparral, mid to upper montane coniferous forest, meadows and seeps, North Coast coniferous forest; elevation 5100-6200 feet. Known from South fork Mtn., Trinity County.		

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Scientific Name (Common Name)	General Habitat Description	Potential to Occur Y/N	Reason for Non-consideration for Project Area
<i>Fritillaria eastwoodiae</i> Butte County fritillary	Dry benches & slopes, chaparral, woodlands and lower mixed conifer opening; elevation 160-4900 feet. Known to occur in the Squaw Creek and Pit River Arm.		
<i>Harmonia doris-nilesiae</i> Nile's madia	Chaparral, cismontane woodland and lower montane coniferous forests; usually on serpentine; elevation 2100-5500 feet. Trinity County		
<i>Harmonia stebbinsii</i> <i>Stebbins' madia</i>	Chaparral and lower montane coniferous forest on serpentine; elevation 2100-6000 feet.		
<i>Howellia aquatilis</i> water howellia (federal listed Threatened)	Marshes and swamps (fresh water); elevation; 3560-4230 feet.		
<i>Hydrotheria venosa</i> veined water lichen	Aquatic, in spring-fed streams that never flood		
<i>Iliamna latibracteata</i> <i>California wild hollyhock</i>	North Coast coniferous forest (mesic); elevation 1640-6560 feet. Del Norte, Humboldt & Siskiyou Cos.		
<i>Ivesia longibracteata</i> <i>Castle Crags ivesia</i>	Granite & diorite outcrops near and above timberline; Castle Crags endemic; elevation 4400-4800 feet		
<i>Ivesia pickeringii</i> <i>Pickering's ivesia</i>	Ephemeral drainages & seasonally wet grassy slopes in mixed conifer forest, on ultramafic soils; elevation 2500-4500 feet; Scott Mtns.-Shasta Valley.		

**Sensitive Plant species known or potentially occurring on the Shasta National Forest including Shasta Lake, Mt. Shasta and McCloud Ranger Districts as of October 1, 2006**

Scientific Name (Common Name)	General Habitat Description	Potential to Occur Y/N	Reason for Non-consideration for Project Area
<i>Leptosiphon nuttallii</i> Mt. Tedoc linanthus	Mid to upper montane coniferous forest/serpentine soils; elevation 4000-9200 feet. Mt. Tedoc, Klamath Mtns., Tehama County.		
<i>Lewisia cantelovii</i> Cantelow's lewisia	Moist rock outcrops in broad-leaf and conifer forests (mesic)/ granitic, sometimes serpentinite seeps; elevation 500-3000 feet.		
<i>Meesia triquetra</i> three-ranked hump-moss bryophyte	Bogs and fens, meadows and seeps, subalpine coniferous forest and upper montane coniferous forest		
<i>Meesia uliginosa</i> broad-nerved hump-moss bryophyte	Bogs and fens, meadows and seeps, subalpine coniferous forest and upper montane coniferous forest		
<i>Mielichhoferia elongata</i> elongate copper moss bryophyte	Mesic, exposed soil or rock containing copper minerals; road cuts; elevation 1640-4260 feet. Not known to occur in Shasta County. Known to occur in western Trinity County.		
<i>Minuartia rosei</i> Peanut sandwort	Lower montane coniferous forest/serpentinite; elevation 2500-5800 feet		
<i>Minuartia stolonifera</i> Scott Mountain sandwort	Rocky slopes on ultramafic soils; montane mixed conifer forest; elevation 2400-3000 feet. Scott Mountain		
<i>Montia howellii</i> Howell's Montia	Meadows and seeps, North Coast coniferous forest and vernal pools; elevation 0-1950 feet		
<i>Neviusia cliffonii</i>	Cismontane woodland, lower montane		

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Scientific Name (Common Name)	General Habitat Description	Potential to Occur Y/N	Reason for Non-consideration for Project Area
Shasta snow-wreath	coniferous forest, riparian woodland/ often stream-sides; sometimes carbonate, volcanic or metavolcanic; elevation 990-1640		
<i>Ophioglossum pusillum</i> Northern adder's tongue fern	Marshes and swamps and valley and foothill grassland; elevation 740-3280 feet. Historically (1894) known to occur in Sisson (Mt. Shasta City). Closest occurrence is in Mendocino County		
<i>Orcuttia tenuis</i> slender Orcutt-grass (also listed by state & fed.)	Flood plains, vernal pools, reservoir edges on clay soils; elevation 110-5700 feet.		
<i>Parnassia cirrata</i> var. <i>intermedia</i> fringed grass –of-parnassus	Lower montane coniferous forest, meadows and seeps and upper montane coniferous forest/ mesic, stream-sides sometimes calcareous: elevation 2560-9840 feet.		
<i>Penstemon filiformis</i> thread-leaf beardtongue	Rocky openings in lower montane coniferous forest/ ultramafic soils; 2000-6000 feet.		
<i>Phacelia cookei</i> <i>Cook's Phacelia</i>	Lightly disturbed openings, ashy volcanic soils; elevation 4100-5000 feet.		
<i>Phacelia greenei</i> <i>Scott Valley Phacelia</i>	Gravelly serpentinized ridges & forest openings; elevation 5000-7000 feet. Scott Mountains		
<i>Phaeocollybia olivacea</i> olive phaeocollybia fungi	Scattered to densely gregarious, often in rings on the ground in mixed woods and under conifers; fruiting in fall and winter.		



**Sensitive Plant species known or potentially occurring on the Shasta National Forest including Shasta Lake, Mt. Shasta and McCloud Ranger Districts as of October 1, 2006**

Scientific Name (Common Name)	General Habitat Description	Potential to Occur Y/N	Reason for Non-consideration for Project Area
	Historical site; Castle Crags State Park, Nov. 1967 (Coast & Klamath Ranges).		
<i>Polemonium chartaceum</i> Mason's sky pilot	Alpine talus & rock outcrops; elevation 8500 & above.		
<i>Ptilidium californicum</i> Pacific fuzzwort bryophyte	Generally found growing at the base of larger white fir trees, stumps and logs in relatively undisturbed old growth/late seral habitats. Elevation 3500-5500 feet		
<i>Raillardella pringlei</i> showy railardella	Wet ultramafic meadow, seeps & streambanks; elevation 4000-7500 feet.		
<i>Rorippa columbiae</i> <i>Columbia cress</i>	Seasonal lakebeds & drainages east of Cascade crest; elevation 500-5900 feet		
<i>Sedum paradisi</i> Canyon Creek stonecrop	Broadleaf upland forest, chaparral, lower montane coniferous forest and subalpine coniferous forest; elevation 960-6500 feet.		
<i>Silene occidentalis</i> ssp. <i>longistipitata</i> Long-stiped campion	Chaparral and lower and upper montane coniferous forest; elevation 3280-6560 feet		
<i>Smilax jamesii</i> English Peak greenbriar	Lakesides, streambanks, riparian areas in moist montane coniferous forest; elevation 2900-7500 feet. Known to occur at Iron Canyon Reservoir, NE of Shasta Lake		
<i>Sowerbyella rhenanas</i> stalked orange peel fungus fungus	Moist, undisturbed, older conifer forests. Generally coastal. Historical site; Castle Crags State Park, Dec. 1964 (Coast and Klamath Ranges).		

**Sensitive Plant species known or potentially occurring on the Shasta National Forest including Shasta Lake, Mt. Shasta and McCloud Ranger Districts as of October 1, 2006**

Scientific Name (Common Name)	General Habitat Description	Potential to Occur Y/N	Reason for Non-consideration for Project Area
<i>Sulcaria badia</i> bay horsehair lichen	Usually on hardwoods (white oak), sometimes conifers. Known from Mendocino Co. / Pollution sensitive.		
lichen			

# MODOC NATIONAL FOREST

## Threatened, Endangered, and Sensitive Plants According to the October 2006 Regional Forester's List

Code	Endangered Species	Common Name	District of Suspect	Flowers	Habitat
TUGR	<i>Tuctoria greenei</i>	Greene's tuctoria	BV, DG, DH	May –July	Vernal pools and swales. Suspected.

Code	Threatened Species	Common Name	District of Suspect	Flowers	Habitat
ORTE	<i>Orcuttia tenuis</i>	Slender Orcutt grass	BV, DG, DH	May-July	Vernal pools and swales.

Code	Sensitive Species	Common Name	District of Suspect	ID Period	Habitat
ASAN18	<i>Astragalus anxius</i>	Ash Valley milk-vetch	BV	May-July	<p>Arid flats in or near juniper-sagebrush steppe or upper montane <sup>Pinus jeffreyi</sup> PIJE woodland.</p> <p>Gravelly, shallow volcanic soils assoc. w. openings in the forest or scrub. Spongy, ash-gravel aggregate overlying semi-exposed bedrock; well-drained, loose, often only a few cm. deep.</p> <p>Artemisia tridentata Juniperus occidentalis Eriogonum prociduum Phacelia hastata Mentzelia albicaulis Ipomopsis congesta            Assoc.: ARTR2, J U O C , E R P R 9, PHHA, MEAL6, IPCO5,            Packera cana Ivesia paniculata Ceratophylla testiculata Alyssum alyssoides Sisymbrium altissimum Bromus tectorum            PACA15, IVP A, C E T E 5, ALAL3, S I A L 2, B R T E.</p> <p>4,725–5,450 ft.</p>
ASLE6	<i>Astragalus lemmonii</i>	Lemmon's milk-vetch	BV, DG, DH, WM	May-August	<p>Great Basin sagebrush scrub, usu. occurs in wetlands (meadows, lake shores, seeps, marshes, swamps)</p> <p>3,075–7,225 ft.</p>
ASPUC	<i>Astragalus pulsiferae</i> var. <i>coronensis</i>	crown milkvetch	BV, DG, WM	May-August	<p>Great Basin Scrub, Lower Montane Coniferous Forest, Piñon and Juniper Woodland</p> <p>Loose, often rocky volcanic soils; sandy silt, friable at the surface, hard-packed beneath, among basalt cobble and gravel</p> <p>Juniperus occidentalis Artemisia tridentata Purshia tridentata Pinus jeffreyi            Assoc.: J U O C , ARTR2, PUTR2, PIJE.</p> <p>4,100–6,200 ft.</p>
BOAS2	<i>Botrychium ascendens</i>	upswept moonwort	BV, DH, WM	July-August	<p>Lower montane yellow pine forest; mesic.</p> <p>Open habitats: coniferous woods near streams, grassy fields, meadows, fens, creek banks. Moist ground, shady, north-facing slopes.</p> <p>Maianthemum stellatum Pinus ponderosa Aquilegia formosa            Assoc.: M A S T 4, P I P O, A Q F O</p> <p>4,575–7,500 ft.</p>
BOCR	<i>Botrychium crenulatum</i>	scalloped moonwort	BV, DH, WM	June-September	<p>Fens, meadows, seeps, freshwater marshes and swamps in lower montane yellow pine forest.</p> <p>Grows in saturated soils of seeps and along stabilized margins of small streams amongst dense herbaceous vegetation, partly to heavily shaded. One of the most hydrophilic of the genus.</p> <p>4,925–10,775 ft.</p>
BOLU	<i>Botrychium lunaria</i>	moonwort	BV, DH, WM	July-August	<p>Fields, meadows and seeps in upper montane to subalpine coniferous forests.</p> <p>Moist but well-drained soils with neutral pH. At high elev., in open to lightly wooded meadows or sparsely veg. scree slopes. At lower elev., in mesic woodlands, meadows, sparsely veg. sand dunes.</p> <p>7,475–11,150 ft.</p>

Code	Sensitive Species	Common Name	District of Suspect	ID Period	Habitat
BOMI	<i>Botrychium minganense</i>	Mingan moonwort	BV, DH, WM	July-September	Streamsidings, wet or dry meadows, and fens in dense or open lower or upper montane yellow pine forest. Assoc. w. disturbances over 10 years old. Open sun to dense herbaceous cover. 4,925–6,750 ft.
BOMO	<i>Botrychium montanum</i>	western goblin	BV, DH, WM	July-September	<small>Calocedrus decurrens</small> Lower, upper montane Yellow Pine Forest, among CADE27. Wet areas: fens, meadows, riparian corridors, and seeps, all saturated. Moist, shady coniferous forests. Moist soil with high mineral content or high in organic matter (often Cupressaceous leaf litter) under incense cedar. Low elevations to subalpine. 4,925–7,000 ft.
BOPI	<i>Botrychium pinnatum</i>	northwestern moonwort	BV, DH, WM	July-October	Grassy fields, shrubby slopes, meadows and seeps in lower, upper montane red fir, lodgepole, or yellow pine forests Moist grassy sites in open forests and meadows, near streams and other places where soil moisture is constant. 5,800–6,700 ft.
BOPU2	<i>Botrychium pumicola</i>	pumice moonwort	DH	July-September	<small>Pinus contorta Pseudotsuga tridentata Pinus albicaulis</small> From subalpine PICO-P U T R or P I A L forest to above timberline. Usu. in open, sparsely veg. sites, but possibly in lodgepole-bitterbrush forests with substantial herbaceous cover. Loose, dry, coarse to fine pumice gravel and sand without humus, in pumice fields and treeless ridges to gently rolling slopes. From completely sun-exposed to partially tree-covered sites. In lodgepole basin frost pockets or other areas that retain moisture in late spring; seasonally moist to dry. <small>Elymus elymoides elymoides Trisetum spicatum Carex breweri Eriogonum ovalifolium Eriogonum pyrrolifolium</small> Assoc.: E L E L E , TRSP2, CABR12, E R O V , E R P Y 2 , <small>Eriogonum umbellatum Polygonum davisiac Phlox diffusa Phacelia egeana Castilleja pilosa pilosa Penstemon davidsonii</small> E R U M , P O D A , PHDI3, PHEG, C A P I P , P E D A 2 , <small>Machaeranthera canescens shastensis Hulsea nana Raillardella argentea Hieracium gracile</small> M A C A S 3 , HUNA, R A A R , H I G R . 5,900–8,875 ft.
BRBO2	<i>Bruchia bolanderi</i>	Bolander's candle-moss	DG, WM	August-September	Lower, upper montane lodgepole forest: alpine and subalpine ( <i>i.e.</i> , high mountain) meadows, soil banks of streamlets in meadows. Forms large colonies in openings on moist, disturbed soil with organic content, or occurs individually among grasses; shaded to full sun; takes advantage of disturbed sites and minimal competition from other vegetation. <small>Pinus contorta Aulacomnium palustre</small> Assoc.: PICO, A U P A , <i>Poblia</i> spp. 5,575–9,200 ft.
BUVI2	<i>Buxbaumia viridis</i>	bug-on-a-stick moss	DG, WM	July-August	Rotting decorticated wood (logs and stumps) or humus banks in subalpine coniferous forest.
CALOL	<i>Calochortus longebarbatus</i> var. <i>longebarbatus</i>	longhaired startulip	BV, DG, DH	June-August	Low, grassy meadows, openings, and drainages in lower montane yellow pine forest or Great Basin scrub. Heavy clay or possibly sandy soils, at the margins of seasonally wet meadows, and along grassy banks of streamlets, often on the edges of pine forests. 2,950–6,250 ft.
CYMO2	<i>Cypripedium montanum</i>	mountain lady's-slipper	BV, DG, DH, WM	May-July	Open, moist lower montane yellow pine or mixed evergreen woods, along the mountains; or alpine meadows. Moist areas, dry slopes, 60 to 80 percent canopy closure; from full sun on eastern mountain slopes to full shade in moist wooded valleys. Moist open woods and alpine meadows. 600–7,300 ft.



Code	Sensitive Species	Common Name	District of Suspect	ID Period	Habitat
ERPR9	<i>Eriogonum prociduum</i>	prostrate buckwheat	BV, DG, WM	May-August	Dry, rocky, barren, volcanic slopes and flats within the upper montane sagebrush-juniper to Jeffrey pine forest types, and possibly among lodgepole or red fir forest. Very sparsely vegetated, shallow-soiled areas among basalt flows, or occasionally on barren volcanic tuff. 4,250–8,875 ft.
ERUMG	<i>Eriogonum umbellatum</i> var. <i>glaberrimum</i>	green buckwheat	WM, DG	June-September	Lower or upper montane yellow pine, red fir, or lodgepole forest. Sand and gravel. 5,000–7,550 ft.
GAGLM	<i>Galium glabrescens</i> ssp. <i>modocense</i>	Modoc bedstraw	WM	June-July	In Great Basin scrub, near pine-white fir forest. Gravelly slopes, under the edges of rocks, talus. 5,075–9,300 ft.
GASEW	<i>Galium serpenticum</i> ssp. <i>warnereense</i>	Warner Mountain bedstraw	WM	June-July	Subalpine coniferous woodlands, meadows and seeps Serpentine (?). Gravelly slopes, rocky, talus, scree areas; growing at base of rock outcrops, among rocks, and in road cuts. <small>Lianthus pungens Eriogonum umbellatum Eriogonum strictum Phacelia hastata Sedum lanceolatum Holodiscus discolor</small> Assoc.: LIPU11, ERUM, ERST4, PHHA, SELA, HODI, <small>Phlox diffusa Phoenicailis cheiranthoides Steptotis acutis Monardella odontissima Dimeresia howellii</small> PHDI3, PHCH, STAC, MOOD, DIHO2, rabbitbrush. 4,750–9,025 ft.
HEBL2	<i>Helodium blandowii</i>	Blandow's bog-moss	DH, WM	July-September	Subalpine coniferous forests; meadows and seeps Bog and fen habitats, damp soil. 6,550–8,875 ft.
IVPA	<i>Ivesia paniculata</i>	Ash Creek mouse-tail	BV	June-September	Open sagebrush scrub, somewhat near upper montane juniper-Jeffrey pine woodland, or possibly lodgepole or red fir forest. Low open volcanic ridges, exposed volcanic mounds; barren, shallow, rocky or gravelly soils; openings and gravelly flats. <small>Packeria cana Iponopsis congesta Castilleja pilosa pilosa Machaeranthera canescens</small> Assoc.: <i>Artemisia</i> spp., PACA15, IPCO5, CAPIP, MACA2, <small>Eriogonum sphaerocephalumhalimoides Eriogonum prociduum Astragalus tegetarioides Astragalus filipes Astragalus curvicaupus</small> ERSPH, ERPR9, ASTE4, ASFI, ASCU4, <small>Phacelia linearis</small> PHLI. 4,925–6,400 ft.
LORO7	<i>Lomatium roseanum</i>	roseflowered desertparsley	DG, WM	May-June	Within low sagebrush vegetation. Open, dry, basalt talus stripes and scree fields overlying clay soils on gentle slopes; also occurs directly on black adobe soil. <small>Artemisia arbuscula Poa secunda Elymus clymoides Arenaria aculeata Erigeron linearis</small> Assoc.: ARAR8, POSE, ELEL5, ARAC2, ERLI, <i>Phlox</i> spp., etc. 5,725–6,175 ft.
LULAB	<i>Lupinus latifolius</i> var. <i>barbatus</i>	bearded lupine	BV, DG, DH, WM	June-July	Wet places in mesic upper montane coniferous forest. 4,925–8,200 ft.
METR70	<i>Meesia triquetra</i>	threeranked hump-moss	DH, WM	July-September	Fens and wetland sites within mesic upper montane forest; possibly on soil. Rich fens having surface waters with pH from 5.5-7.5 and calcium concentrations. <small>Aulacomnium palustre Bryum pseudotriquetrum Scorpidium scorpioides Limprichtia revolvens Betula pumila</small> Assoc.: AUPA70, BRPS70, SCSC70, LIRE13, BEPU4, <small>Menyanthes trifoliata Comarum palustre</small> METR3, COPA28. 4,250–8,200 ft.
MEUL70	<i>Meesia uliginosa</i>	broadnerved hump-moss	DH, WM	August-September	Meadows, fens, seeps in upper montane coniferous forest; damp soil. 4,250–8,200 ft.

Code	Sensitive Species	Common Name	District of Suspect	ID Period	Habitat
MIEV	<i>Mimulus evanescens</i>	ephemeral monkeyflower	BV, DG, DH, WM	June	Sagebrush scrub, lower montane juniper woodland. Found among rock fragments and alongside small boulders, in moist, heavy gravel, inundated in spring; often near the edges of reservoirs, on fluctuating banks of intermittent streams or pools, rocky stream banks, or drying watercourses. <small>Artemisia tridentata Juniperus occidentalis Mimulus floribundus Mimulus suksdorfii Porterella carnosula Collinsia grandiflora</small> Assoc.: ARTR2, J U O C, MIFL2, MISU2, POCA15, COGR2, <small>Collinsia parviflora Mimetanthe pilosa Heterocodon raniflorum Poa bulbosa</small> COPA3, MIPI5, HERA3, POBU, <i>Downingia</i> spp. 4,100–5,575 ft.
PHIN3	<i>Phacelia inundata</i>	playa phacelia	DG, DH	May-August	Sagebrush scrub, lower montane yellow pine forest. In areas with clay soils, inundated early in the season.. Alkali sinks, subalkaline flats, playas, dry lake margins. 4,900–6,550 ft.
POPOE	<i>Polygonum polygaloides</i> ssp. <i>esotericum</i>	Modoc County knotweed	DG, DH	April-August	Sagebrush scrub, lower montane juniper woodland, freshwater wetlands. Seasonally dry adobe flats and pond basins, meadows, mesic vernal pools, swales, and similar habitats. 4,500–5,550 ft.
PTCA5	<i>Ptilidium californicum</i>	Pacific fuzzwort	DH		<small>Tsuga mertensiana Pseudotsuga menziesii Abies concolor</small> Mature to old growth T S M E, P S M E, or ABCO, unburned for at least 30 years On bark of trees, tree limbs, bushes, and logs; on small conifers 'on higher geomorphic surfaces.' Living or young decaying wood with intact bark; living in bark or cortex of decaying stumps and logs. In wet places 1,575–4,100 ft.
ROCO3	<i>Rorippa columbiae</i>	Columbia yellow-cress	BV, DG, DH	June-September	Mesic northern juniper woodland In cyclically moist areas, generally along rivers and seasonal riverbeds, drying shores of shallow lakes, meadows, seeps, playas, alkali sinks, mud flats of old lake shores, and other vernal wet sites near the water's edge. In gravelly soil, pumice sand; among volcanic boulders, away from competing species in open, high-light sites. Assoc.: <i>Psilocarphus</i> spp., <i>Allocarya</i> spp., <i>Polygonum</i> spp., <i>Juncus</i> spp. 3,925–5,900 ft.
THHOH	<i>Thelypodium howellii</i> ssp. <i>howellii</i>	Howell's thelypody	BV, DG, DH, WM	May-July	Great Basin scrub, alkaline adobe meadows and seeps. 3,850–5,850 ft.

# **APPENDIX G: SENSITIVE WILDLIFE DESCRIPTIONS**





Scientific Name	Common Name	Anges	Cleveland	Eldorado	Inyo	Klamath	Lassen	Los Padres	Mendocino	Modoc	Plumas	San Bernardino	Sequoia	Shasta-Trinity	Six Rivers	Sierra	Stanslaus	Tahoe	Lake Tahoe Basin
<i>Xantusia vigilis sierrae</i>	Sierra night lizard				X									X					
<i>Elgaria panamintina</i>	Panamint alligator lizard																		
<b>REPTILES continued</b>																			
<i>Anniella pulchra</i>	California legless lizard	X	X																
<i>Diadophis punctatus modestus</i>	San Bernardino ringneck snake	X					X					X							
<i>Diadophis punctatus similis</i>	San Diego ringneck snake	X										X							
<i>Charina bottae umbratica</i>	Southern rubber boa	X					X					X							
<i>Lichanura trivirgata roseofusca</i>	Coastal rosy boa	X	X									X							
<i>Lampropeltis zonata parvinubra</i>	San Bernardino Mtn. kingsnake	X										X							
<i>Lampropeltis zonata pulchra</i>	San Diego Mountain Kingsnake	X	X									X							
<i>Thamnophis hammondi</i>	Two-striped garter snake	X	X									X							
<b>TERRESTRIAL INVERTEBRATES (7)</b>																			
<i>Monadenia troglodytes troglodytes</i>	Shasta sideband snail													X					
<i>Monadenia troglodytes wintu</i>	Wintu sideband snail													X					
<i>Prophysaon coeruleum</i>	Blue-Gray Taildropper slug				X										X				
<i>Triobopsis roperi</i>	Shasta chapparrai snail													X					
<i>Triobopsis tehamae</i>	Tehama chapparrai snail				X									X					
<i>Vespericola pressleyi</i>	Pressley hesperian snail													X					
<i>Vespericola shasta</i>	Shasta hesperian snail													X					
<b>AQUATIC INVERTEBRATES (8)</b>																			
<i>Anodonta californiensis</i>	CA floater (freshwater mussel)								X										X
<i>Fluminicola seminolis</i>	Nugget Pebblesnail (snail)													X					
<i>Helisoma newberryi newberryi</i>	Great Basin rams-horn (snail)													X					X
<i>Juga (Calibasis) acutiflora</i>	Topaz Juga (snail)									X									
<i>Juga (Calibasis) occata</i>	Scalloped Juga (snail)													X					
<i>Piscidium (Cyclocalyx) ultramontanum</i>	Montane peaclam													X					
<i>Pyrgulopsis owensensis</i>	Owen's Valley springsnail				X														
<i>Pyrgulopsis wongi</i>	Wong's springsnail				X														
<b>FISHES (19)</b>																			
<i>Catostomus occidentalis lacusanserinus</i>	Goose Lake sucker									X									
<i>Gasterosteus aculeatus microcephalus</i>	Partially armored 3spine stickleback																X		
<i>Gila bicolor pectinifer</i>	Lahontan Lake tui chub																		X
<i>Gila bicolor thalassina</i>	Goose Lake tui chub													X					
<i>Gila orcutti</i>	Arroyo chub	X	X											X					
<i>Lampetra tridentata ssp.</i>	Goose Lake lamprey													X					
<i>Lavina exilicauda chi</i>	Clear Lake hitch									X									
<i>Mylopharodon conocephalus</i>	Hardhead													X					
<i>Oncorhynchus mykiss aguabonita</i>	Volcano Creek golden trout													X					
<i>Oncorhynchus mykiss aquilarum(pop 5)</i>	Eagle Lake rainbow trout													X					
<i>Oncorhynchus mykiss pop 4</i>	Waiyer Valley redband trout									X									
<i>Oncorhynchus mykiss pop 6</i>	Goose Lake redband trout													X					
<i>Oncorhynchus mykiss pop 7</i>	Goose Lake redband trout													X					
<i>Rhinichthys osculus ssp 8</i>	McCloud River redband trout													X					
<i>Oncorhynchus mykiss</i>	Santa Ana speckled dace	X	X											X					
<i>Oncorhynchus mykiss</i>	Steelhead - Klamath Mtn. Prov. ESU													X					X
<i>Oncorhynchus clarkii</i>	Coastal run cutthroat trout													X					X
<i>Oncorhynchus tshawytscha</i>	Central Valley fall & late-fall run chinook ESU													X					
<i>Oncorhynchus tshawytscha</i>	Up Klam/Trinity chinook ESU-spr run													X					X
<i>Oncorhynchus tshawytscha</i>	Upper Trinity Riv. chinook ESU-fall run													X					X

**R5 Total Sensitive Animals = 91** Total # Sensitive Animals per Forest

24	19	18	23	22	27	20	17	23	19	31	26	29	20	15	21	20	13
ANF	CNF	ENF	INF	KNF	LNf	LPF	MNF	MDF	PNF	BDF	SOE	SHF	SNF	SRF	STF	TNF	TMU

## Appendix G1: Project Area Special Status Wildlife Species

Common Name (Scientific Name)	Listing Status	Habitat	Potential to Occur on Site
<b>Invertebrates</b>			
Shasta Crayfish ( <i>Pacifastacus fortis</i> )	Federal: Endangered State: Endangered State Rank: S1 USFS: Not listed	Shallow water with rocky bottoms. Also in spring pools and clear lakes.	None
Mardon skipper butterfly ( <i>Polites mardon</i> )	Federal: Candidate State: Not listed State Rank: S1 USFS: Not listed	Serpentine outcrops. Also grassy clearings in mountainous, subalpine coniferous forests.	None
Blue-Gray Taildropper slug ( <i>Prophysaon coeruleum</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	In Klamath Mountains and northern Cascade Range in California.	None
Tehama chaparral snail ( <i>Trilobopsis tehamana</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Carbonate cliffs or calcareous substrates.	None
California floater ( <i>Anodonta californiensis</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Aquatic.	None
Nugget Pebblesnail ( <i>Fluminicola seminalis</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Aquatic.	None
Scalloped juga ( <i>Juga [Calibasis] occata</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Aquatic.	None
Topaz juga ( <i>Juga [Calibasis] acutifilosa</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Aquatic.	None
Montane peaclam ( <i>Pisidium [Cyclocalyx] ultramontanum</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Aquatic.	None
<b>Amphibians</b>			
California red-legged frog ( <i>Rana aurora draytonii</i> )	Federal: Threatened State: Not listed State Rank: S2S3 USFS: Not listed	Thick vegetation near quiet water of marshes and streams.	None
Oregon Spotted frog ( <i>Rana pretiosa</i> )	Federal: Candidate State: Not listed State Rank: S1 USFS: Sensitive	Vegetated banks of quiet, permanent water. Avoids dry areas.	None
Foothill yellow-legged frog ( <i>Rana boylei</i> )	Federal: Not listed State: Not listed State Rank: None	Aquatic.	None

## Appendix G1: Project Area Special Status Wildlife Species

Common Name (Scientific Name)	Listing Status	Habitat	Potential to Occur on Site
	USFS: Sensitive		
Cascade frog ( <i>Rana cascadae</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Riparian and riverine corridors, and wetlands separated by less than 1km of upland habitat.	None
<b>Birds</b>			
Northern spotted owl ( <i>Strix occidentalis caurina</i> )	Federal: Threatened State: Not listed State Rank: S2S3 USFS: Not listed	Typically old growth forests with large trees and large amounts of woody debris on ground.	Moderate
Yellow-billed cuckoo ( <i>Coccyzus americanus occidentalis</i> )	Federal: Candidate State: Endangered State Rank: S1 USFS: Not listed	Riparian woodlands of greater than 40 hectares	None
Bald eagle ( <i>Haliaeetus leucocephalus</i> )	Federal: Not listed State: Endangered State Rank: S2 USFS: Sensitive	Prefers large, accessible trees. Breeding habitat is within 4 km of bodies of water.	High
Northern goshawk ( <i>Accipiter gentilis</i> )	Federal: Not listed State: Not listed State Rank: S3 USFS: Sensitive	Nests in coniferous and mixed forests of mature or old growth, including hemlock and fir species.	High
Swainson's hawk ( <i>Buteo swainsoni</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Savanna, open pine-oak woodland and cultivated lands with scattered trees. Typically nests in a solitary tree.	Moderate
Willow flycatcher ( <i>Empidonax traillii</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Mountain meadows.	Moderate
Greater sandhill crane ( <i>Grus Canadensis tabida</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Grassland and riparian.	None
Great gray owl ( <i>Strix nebulosa</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Dense coniferous and hardwood forest, especially near water.	Very low
<b>Mammals</b>			
Fisher ( <i>Martes pennanti</i> )	Federal: Candidate State: Not listed State Rank: S2S3 USFS: Not listed	Mid- to low-elevation, dense coniferous, mixed, and deciduous forests. Avoids areas with human activity.	Moderate
Sierra Nevada red fox ( <i>Vulpes vulpes nicator</i> )	Federal: Not listed State: Threatened State Rank: S1 USFS: Sensitive	Red fir and lodgepole pine forests. Hunts in clearings and rocky areas.	High
Taylor pika	Federal: Not listed State: Not listed	Dark-colored lava fields at 5,000-9,000 feet in elevation. In areas with	High

## Appendix G1: Project Area Special Status Wildlife Species

Common Name (Scientific Name)	Listing Status	Habitat	Potential to Occur on Site
<i>Ochotona princeps taylori</i>	State Rank: S2S4 USFS: Not listed	adequate cover and talus rock occur.	
American marten ( <i>Martes Americana</i> )	Federal: Not listed State: Not listed State Rank: S3S4 USFS: Sensitive	Dense deciduous, mixed, or coniferous forest. Also forested wetland.	High
Western mastiff bat ( <i>Eumops perotis californicus</i> )	Federal: Not listed State: Not listed State Rank: S3 USFS: Not listed	Roosts in areas high above ground on sides of cliffs and in rocky crevices.	Low
Long-eared myotis ( <i>Myotis evotis</i> )	Federal: Not listed State: Not listed State Rank: S4 USFS: Not listed	Forested areas with rocky outcrops. Also shrublands and along streams. Roosts in crevices in trees and caves.	High
Silver-haired bat ( <i>Lasionycteris noctivagans</i> )	Federal: Not listed State: Not listed State Rank: S3S4 USFS: Not listed	Forested areas near lakes and streams. Also roosts in trees, but rarely in caves.	High
Pallid bat ( <i>Antrozous pallidus</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Dry grasslands near rock outcrops. Roosts in buildings, rock crevices, or under bridges.	High
Townsend's big-eared bat ( <i>Corynorhinus townsendii</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Lava tubes, coniferous and deciduous forests. Avoids grasslands as much as possible	Moderate
Pacific fisher ( <i>Martes pennanti pacifica</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Mature forests with high multiple-layer canopy closure, large trees and woody debris.	Low
<b>Fish</b>			
Lost River sucker ( <i>Deltistes luxatus</i> )	Federal: Endangered State: Endangered State Rank: S1 USFS: Not listed	Deep-water lakes, and tributary streams. Prefers shorelines with vegetation for cover from predators.	None
Shortnose sucker ( <i>Chasmistes brevirostris</i> )	Federal: Endangered State: Endangered State Rank: S1 USFS: Not listed	Freshwater.	None
Sacramento splittail ( <i>Pogonichthys macrolepidotus</i> )	Federal: Threatened State: Not listed State Rank: S2 USFS: Not listed	Freshwater.	None
Rainbow trout ( <i>Oncorhynchus mykiss</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Freshwater.	None
Chinook salmon ( <i>Oncorhynchus tshawytscha</i> )	Federal: Not listed State: Not listed	Freshwater.	None



## Appendix G1: Project Area Special Status Wildlife Species

Common Name (Scientific Name)	Listing Status	Habitat	Potential to Occur on Site
	State Rank: None USFS: Sensitive		
Warner Valley redband trout ( <i>Oncorhynchus mykiss pop 4</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Freshwater.	None
McCloud River redband trout ( <i>Oncorhynchus mykiss pop 7</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Freshwater.	None
Steelhead ( <i>Oncorhynchus mykiss</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Freshwater.	None
<b>Reptiles</b>			
Northwestern pond turtle ( <i>Clemmys marmorata marmorata</i> )	Federal: Not listed State: Not listed State Rank: None USFS: Sensitive	Freshwater.	None

## Appendix G2: Sensitive Species with a Very Low, Moderate, High, or Very High Likelihood to Occur in the Project Area

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### VERY LOW LIKELIHOOD

**Great gray owls (*Strix nebulosa*)** are commonly found in dense stands of old growth red fir, lodgepole pine, or mixed conifer that are adjacent to preferred foraging habitat in meadows. Potential foraging habitat for this species exists at the meadows near Medicine Lake.

### LOW LIKELIHOOD

**Western mastiff bats (*Eumops perotis californicus*)** are large, high-flying bats that have been recorded once in the Medicine Lake Highlands. It is possible that individuals could forage over the project area occasionally in summer, but the lack of suitable diurnal roosting habitat (in the form of cliff faces or vertical rock outcrops) makes it unlikely that this species is resident in the project area. All portions of the proposed project could provide occasional foraging habitat for this species, although it is unlikely to find roosting habitat in or near any of the project facilities.

**Pacific fishers (*Martes pennanti pacifica*)** are commonly found in areas of extensive stands of mature, dense forest with a high level of canopy closure. Two historic sightings of the Pacific fisher were recorded from the vicinity of Medicine Lake, but these may have been dispersing individuals. Only marginal habitat is available for the Pacific fisher in the project areas.

### MODERATE LIKELIHOOD

**Northern spotted owls (*Strix occidentalis caurina*)** primarily live in old growth and late-successional forest ecosystems in Washington, Oregon, and northern California. Northern spotted owls are primarily associated with conifer forests in Northern California at elevations from sea level to approximately 7,600 feet. They utilize a variety of forest stand structures for nesting, roosting, and foraging behavior. Roosting and foraging habitats are typically interspersed and could vary in stand structure and canopy closure.

**Swainson's hawks (*Buteo swainsoni*)** breed in the open habitats of northeastern California, where it uses scattered trees as nest sites. This species migrates to the south in the fall and returns to northeastern California the following spring.

**Willow flycatchers (*Empidonax traillii*)** breed in brushy areas of willow and similar shrubs. They can also be found in thickets, open second growth with brush, swamps, riparian areas, and open woodland. A body of water, such as a stream or lake, and deciduous riparian shrubs are necessary elements for suitable habitat. It mainly eats insects caught in flight, and will occasionally eat berries.

**Fishers (*Martes pennanti*)** live in upland and lowland coniferous, mixed, and deciduous forests. They occur in early successional forests with a thick overhead canopy. The Fisher will avoid areas lacking a forest cover, or with substantial human disturbance. They may live in a tree hollow, under a log, or in a rock crevice.

**Townsend's big-eared bats (*Corynorhinus townsendii*)** are known from the Lava Beds National Monument to the north of Fourmile Hill. The Townsend's big-eared bat is commonly found in caves and lava tubes that serve both as summer maternity roosts and winter hibernacula. This species is expected to occur on the Modoc Plateau, where caves and lava tubes are present. High quality roosting habitat includes caves, mines, or buildings. Large spaces within the rocky matrix of the Grouse Hill Glass Flow and the Medicine Lake Glass Flow

may provide diurnal shelter during the summer, and this species is very likely to be present in these areas.

## **HIGH LIKELIHOOD**

**Sierra Nevada red foxes (*Vulpes vulpes necator*)** occupy various habitats in alpine and subalpine zones. The preferred forest habitat consists of red fir and lodgepole pine, and alpine fell-fields. Dens are often made in rock slide areas. The Sierra Nevada red fox typically hunts in meadows, forest clearings, and sparse rocky areas.

**Taylor Pikas (*Ochotona princes taylori*)** lives in talus and boulder-covered hillsides in alpine and subalpine forests, typically along the meadow-talus border. The habitat expands upward to the vegetation limit. At lower elevations, it is found in rocker areas in forests or near lakes. The Taylor pika will also make a nest site in rock crevices.

**American martens (*Martes Americana*)** require mature coniferous forest with dense canopy as the highest quality habitat for this species. Potential denning habitat can include areas with large snags, abundant large-sized downed wood, or rocky outcrops. The American marten has been observed regularly throughout the Medicine Lake Highlands and is known to use all timber types in this region, including lodgepole pine forest.

**Long-eared myotis (*Myotis evotis*)** are primarily associated with montane coniferous forest in northern California. Diurnal roosts have been reported in tree cavities, under exfoliating bark, and in rock crevices. This bat is very likely to be present throughout the Medicine Lake Highlands, where suitable roosting habitat is available.

**Silver-haired bats (*Lasionycteris noctivagans*)** are widespread in coniferous, forest habitat in northern California, often at high elevations. Summer roosts are almost exclusively in large trees, where it uses cavities and exfoliating bark. It can travel considerable distances between roost sites and foraging habitat. The silver-haired bat is very likely to be present in the Medicine Lake Highlands and may be associated with mature forest stands.

**Pallid bats (*Antrozous pallidus*)** are found in a wide variety of habitats in California, from deserts to coniferous forests. This species uses a variety of diurnal roosts, including caves, rock outcrops, and trees with cavities or exfoliating bark. The pallid bat is expected to occur within the at lower elevations from the eastern slopes of the Medicine Lake Highlands down onto the Modoc Plateau.

**Bald eagles (*Haliaeetus leucocephalus*)** typically breed and nest close to bodies of water that also serve as a source of food. Sources of food include fish, injured waterfowl, small mammals, and carrion. The bald eagle may also take food from other birds. Conifers or other sheltered sites serve as roosts in winter, and the bald eagle will often perch in deciduous and coniferous trees.

**Northern Goshawks (*Accipiter gentilis*)** are residents of the Medicine Lake Highlands. Widespread sightings suggest that this species forages in a variety of forested habitats throughout this region. Suitable foraging habitat for the northern goshawk is present throughout the Project area. The optimal northern goshawk nesting habitat includes large trees and high canopy cover. A few red fir stands within the well site area have not been entered for timber harvest and, as a result, support good numbers of large trees and high canopy cover. However, areas with smaller trees and adequate stand density may also be used by goshawks in the area.

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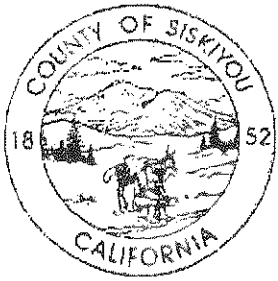
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# **APPENDIX H: SISKIYOU COUNTY WEED POLICY**



# COUNTY OF SISKIYOU

Department of Agriculture

525 SOUTH FOOTHILL DRIVE • YREKA, CALIFORNIA 96097-3090 • (530) 841-4025 • FAX (530) 842-6690

PATRICK J. GRIFFIN

AGRICULTURAL COMMISSIONER  
AIR POLLUTION CONTROL OFFICER

WEIGHTS AND MEASURES  
ANIMAL CONTROL OFFICER

## FACSIMILE TRANSMITTAL SHEET

DATE: 6/17/08

TO: Kristi

FAX NO. 650-373-1211

FROM:	<input type="checkbox"/> Patrick J. Griffin	<input type="checkbox"/> Cyd Krouse
	<input type="checkbox"/> Greg Herman	<input type="checkbox"/> Sherry Detrick
	<input type="checkbox"/> Paul McCanna	<input type="checkbox"/> Tara Beck
	<input type="checkbox"/> Jodi Aceves	<input type="checkbox"/> Randy Casson
	<input checked="" type="checkbox"/> Carolyn Gorden	<input type="checkbox"/> Larry Hicks

         pages including cover sheet

SUBJECT: National wooded land

MESSAGE: Draft copy of wood policy

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Tulelake Branch Office  
P.O. Box 444  
Tulelake, CA 96134-0444  
(530) 667-5310

Air Pollution Control District  
(530) 841-4029

Department of Animal Control  
(530) 841-4028

## SISKIYOU COUNTY NOXIOUS WEED POLICY

The Policy of the Siskiyou County Department of Agriculture, regarding the eradication and control of noxious weed species found within Siskiyou County is as follows:

### CLASSIFICATION OF WEEDS

Weed pests within the meaning of section 5006 of the California Food and Agricultural Code, which are determined to be dangerous or detrimental to the environment, agriculture industry, or public health and safety, are classified by the California Department of Food and Agriculture as follows:

- A & Q Eradication, containment, rejection, or other holding action at the state-county level
- B Eradication, containment, rejection, or other holding action at the discretion of the County Agricultural Commissioner
- C Eradication, containment, rejection, or other holding action at the discretion of the County Agricultural Commissioner

**GROUP I** – Group I weeds generally occur in limited amounts, either as to acreage or the number of infestations. The policy of the Siskiyou County Department of Agriculture is an aggressive eradication program. The Agricultural Commissioner may also call for the eradication of a more widespread weed if the Commissioner determines that weed poses a significant threat to the environment or the agricultural industry.

1. A Spotted knapweed *Centaurea maculosa*
2. A Diffuse knapweed *Centaurea diffusa*
3. A Squarrose knapweed *Centaurea virgata var. squarrosa*
4. A Leafy spurge *Euphorbia esula*
5. A Taurian thistle *Onopordum tauricum*
6. Meadow knapweed *Centaurea jacea x nigra*
7. A Skeletonweed *Chondrilla juncea*
8. A Perennial sow thistle *Sonchus arvensis*

9. A Halogeton *Halogeton glomeratus*
10. A Dalmatian toadflax *Linaria dalmatica*
11. A Scotch thistle *Onopordum acanthium*
12. A Musk thistle *Carduus nutans*
13. B Mediterranean Sage *Salvia aethiopis*
14. B Italian thistle *Carduus pycnocephalus*
15. B Perennial pepperweed *Lepidium latifolium* (Butte, Scott and Shasta valleys)
16. B Purple loosestrife *Lythrum salicaria*
17. B Purplestar thistle *Centaurea calcitrapa* C Sandbur Grass *Cenchrus spp.*

**GROUP II** noxious weed species are more widespread, either as to acreage or the number of infestations but not of general distribution. The policy of the Siskiyou County Department of Agriculture is eradication, containment, control, or other holding action.

1. A Musk thistle, *Carduus nutans*
3. B Perennial peppergrass *lepidium latifolium*
4. B Japanese knotweed, *Polygonum cuspidatum*
5. B Giant knotweed, *Polygonum sachalinense*
6. C Johnsongrass, *Sorghum halepense*
7. B Baby's breath, *Gypsophila paniculata*
8. B Marlahan mustard (Dyer's woad) *Isatis tinctoria* (Eastern Shasta Valley, Butte Valley and Tulelake)

**GROUP III** noxious species are more widespread, either as to acreage or the number of infestations. The policy of the Siskiyou County Department of Agriculture is management, control, or other holding action.

1. B Canada thistle, *Cirsium arvense*
2. B Marlahan mustard, *Isatis tinctoria* (Dyer's woad)



3. B Whitetop, *Cardaria draba*. (Hoary Cress)
4. B Russian knapweed, *Centaurea repens*
5. B Purple mustard, *Chorispora tenella*
6. C Yellowstar thistle, *Centaurea solstitialis*
7. C Puncturevine, *Tribulus terrestris*
8. C Russian thistle, *Salsola spp.*
9. C Kochia, *Kochia scoparia*

#### BIOLOGICAL CONTROL

Biological control agents are usually released when eradication does not appear to be feasible, or when geographic conditions inhibit other control methods. There are also situations when there is a synergistic effect if biological control is combined with other control methods. When considering the release of biological control agents the County will work in cooperation with CDFA and the USDA to select the most effective agents and to insure that proper authorization has been documented.

#### YELLOW STAR THISTLE

- Bangesturnis orientalis*, seed head weevil.
- Eustenopus villosa*, seed head weevil, commonly called the hairy weevil.
- Urophora sirunaseva*, seed head gall fly.
- Chanetorellia succinear*, seed head gall fly.

#### KLAMATH WEED

- Chrysolina Quadridgemina*, leaf eating beetle.
- Agrilus hyperici*, root boring beetle.

#### MUSK THISTLE

- Rhinocyllus conicus*, seed head weevil

#### CANADA THISTLE

- Urophora cardui*- stem gall fly Squarrose knapweed
- Urophora Quadrifasciata*- gall fly

#### RUSSIAN THISTLE

- Coleophora Parthenica*-stem borer

LEAFY SPURGE

*Aphona lacertosa*-flea beetle

*Aphona nigriscutis*-flea beetle

*Oberea erythrocephala*-stem boring beetle

As new biological control agents become available, possible release sites within the county will be explored.

A. Public Property

As authorized by the Board of Supervisors, by authority of section 5405 of the California Food and Agricultural Code, the Commissioner may enter into agreements with public agencies for the treatment of weed pests. ~~The application of material may be made by Siskiyou County Department of Agriculture crews.~~

B. Private Property

1. If the Property owner is willing to enter into an agreement with the Commissioner the entire cost of eradication or control may be borne by the county.
2. If the Property owner fails to enter into an agreement acceptable to the Commissioner and Board of Supervisors, abatement proceedings may be brought under provisions of sections 5401-5436, inclusive, of the food and Agricultural code; the entire cost of the abatement becoming a lien upon the property

Adopted 12/1975


June 12, 2008-Under Revision

# **APPENDIX I: OPEN AND CLOSED ROADS**

Draft Medicine Lake Highlands Road Closure Order

Roads Remaining Open for Public Use			
Route Number	Miles	Route Number	Miles
43A17B	0.1	43N47B	0.3
43A21A	0.1	43N48	4.6
43A47AA	0.1	43N53	1.6
43A48	0.1	43N53Y	2
43A48A	0.3	43N55	0.4
43A48D	0.2	43N56	0.9
43A53YA	0.1	43N58	0.3
43N17	2.9	43N59	0.3
43N19	0.5	43N60	0.3
43N19A	0.5	43N99	9.1
43N19B	0.1	44B17A	0.1
43N21	2.5	44B17C	0.1
43N32	0.6	44N17	4.6
43N42	1.8	44N75	9.9
43N44	0.1	44N75C	0.1
43N47A	0.6	44N75D	0.2
Total Miles of Road Remaining Open		45.4 miles	

Roads Closed for Public Use			
Route Number	Miles	Route Number	Miles
42N22	0.8	43N15	0.3
43A01A	0.1	43N17A	0.6
43A21B	0.7	43N23	1.7
43A21C	0.5	43N23B	0.6
43A42A	0.2	43N23C	0.4
43A48A	0.8	43N29	1.2
43A48B	0.1	43N29A	0.8
43A48D	1.4	43N32	1.2
43A48DA	0.7	43N39	0.7
43A48DB	0.3	43N42A	0.5
43A53A	1.1	43N42B	0.4
43A53B	0.1	43N47	0.9
43A53C	0.9	43N47A	0.7
43A53D	0.4	43N56	1.1
43A53E	0.5	43N66	1.3
43A66A	0.2	43N66A	0.4
43A99A	0.8	44A75BA	0.4
43A99B	1.4	44A75BC	0.3
43N01	1.2	44A75BD	0.1
43N01A	0.3	44A75BE	0.1
43N01B	0.4	44B75A	0.1
43N01C	0.4	44B75B	0
	0	44N75B	0.7
Total Miles of Roads Closed		27.8 miles	

 Represents roads that are partially open and partially closed.

***Decision Framework***

The responsible official will decide whether to adopt and implement the proposed action which will permanently close 28 miles of existing roads and 6.64 miles of known unauthorized user created routes. This will restrict public use to 45 miles of designated NFS roads in the area, or to take no action which will allow the current management direction to remain in place.

***Public Involvement***

This project was initially published on the Modoc National Forest’s Schedule of Proposed Actions (SOPA) on January 2007. A scoping letter was mailed on May 21, 2007, three to individuals, six to groups, three to county government, two to state government and seven to other federal agencies. We received one comment from the public during scoping. This comment was from a private leaseholder who was concerned that his access would be restricted. The proposed action will not restrict authorized use.