MINUTE ITEM

80

08/21/96
W 40722
A. WILLARD
J. ADAMS
E. KRUGER

CALIFORNIA ENERGY GENERAL CORPORATION
(PROPOSED LESSEE)

ITEM PULLED PRIOR TO COMMISSION MEETING

Item attached

CALENDAR PAGE
MINUTE PAGE 001982

CALENDAR ITEM

80

08/21/96
W 40722
A. WILLARD
J. ADAMS
E. KRUGER

CALIFORNIA ENERGY GENERAL CORPORATION
(PROPOSED LESSEE)

ITEM PULLED PRIOR TO COMMISSION MEETING

CALENDAR ITEM
C80

A 2

S 4

08/21/96
W 40722
A. Willard
J. Adams
E. Kruger

APPROVE A NEGOTIATED SUBSURFACE (NO SURFACE USE) GEOTHERMAL RESOURCES LEASE ON ABOUT 449 ACRES OF STATE LAND IN THE GLASS MOUNTAIN AREA, SISKIYOU COUNTY

PROPOSED LESSEE:

California Energy General Corporation
Attn: Vincent Signorotti, Manager of Lands
551 W. Main Street, Suite 1
Brawley, California 92227

AREA, TYPE LAND AND LOCATION:

Approximately 449 acres of State sovereign land located beneath Medicine Lake in portions of Sections 10 and 11, T43N, R3E, MDM in eastern Siskiyou County about 50 miles east of Yreka, California (see Exhibit "A" for land description and location map).

PROPOSED LEASE TERMS:

1. The form of lease provides for "Subsurface Only - No Surface Use".

2. The primary term is ten years and for so long as geothermal resources are being produced or utilized, or are capable of being produced or utilized, in commercial quantities from the leased land or from lands unitized with the leased land, unless sooner terminated as provided in this lease.

3. Royalty of 12 1/2 percent of the value of geothermal resources produced from the leased land. The basis for the value of geothermal resources shall be agreed upon by the State and Lessee prior to commercial utilization. In the event the leased land is unitized with other lands, the royalty shall apply to the leased land's unit participation.

4. Rent of $1.00 per acre per year, payable in advance.

5. Initial drilling requirement is three years. The drilling requirement may be extended by the State for a period of up to two years based on information provided by Lessee justifying the need for an extension.

BACKGROUND:

California Energy General Corporation (C.E.G.C.) has submitted an application for a negotiated subsurface (no surface use) geothermal resources lease comprising approximately 449 acres of State sovereign land beneath Medicine Lake. All exploration and development activities (subsurface) will be conducted by C.E.G.C. from adjacent federal leased land, as no activities are authorized on the surface of the State's land.

PREREQUISITE CONDITIONS, FEES AND EXPENSES:

Filing fee, processing cost and the first year's rent have been received from the Applicant.

STATUTORY AND OTHER REFERENCES:

A. Public Resources Code: Div. 6, Parts 1 and 2; Div. 13.
B. Cal. Code Regs.: Title 3, Div. 3; Title 14, Div. 6.

AB 884:

N/A

OTHER PERTINENT INFORMATION:

1. CEQA Guidelines Section 15378(a)(3) identifies the issuance of a lease as a "project". However, there will be no surface use of the State leased land for any purpose. As such, the location of the development project will be on C.E.G.C.'s adjacent federal leased land within Siskiyou County. The project required approvals from both federal and local agencies. An environmental document was prepared for review as both an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) and as an Initial Study (IS) under the CEQA.

The U. S. Department of the Interior's Bureau of Land Management (BLM) functioned as lead agency for the project subject to NEPA and the Siskiyou County Air Pollution Control District (SCAPCD) functioned as lead agency for the project pursuant to the State CEQA Guidelines (Sections 15000, et. seq.).

The Glass Mountain Unit Geothermal Exploration Project EA/IS (EA #CA027-EA95-06, SCH No. 95041056) was approved by the BLM's Susanville District, Alturas Resource Area, as NEPA lead agency, on August 25, 1995, and the SCAPCD, as CEQA lead agency, approved the project on July 31, 1995. A copy of this document is on file at the offices of the State Lands Commission.

2. The Lessee will be limited to those activities which are analyzed in the environmental document. Should commercial operations become feasible and Lessee chooses to pursue those commercial operations, further environmental documentation from the BLM and the SCAPCD would be required.

3. This activity does not involve lands identified as possessing significant environmental values pursuant to Public Resources Code Sections 6370, et. seq.

4. On May 1, 1993, C.E.G.C. entered into a Geothermal Unit Agreement unitizing their federal leases in the Glass Mountain area. These leases comprise about 37,845 acres. C.E.G.C. has a 70 percent interest in the Unit. Most of the remainder of the Unit is controlled by Freeport-McMoRan. C.E.G.C. proposes that this lease containing approximately 449 acres of State sovereign land is added to the Glass Mountain Unit. If the lease is approved, Paragraph 13 of the lease will give the Commission's consent to become a party to the Unit Agreement.

EXHIBITS:

A. Land Description
B Glass Mountain Unit Geothermal Exploration Project EA/IS, EA#CA027-EA95-06, SCH. No. 95041056

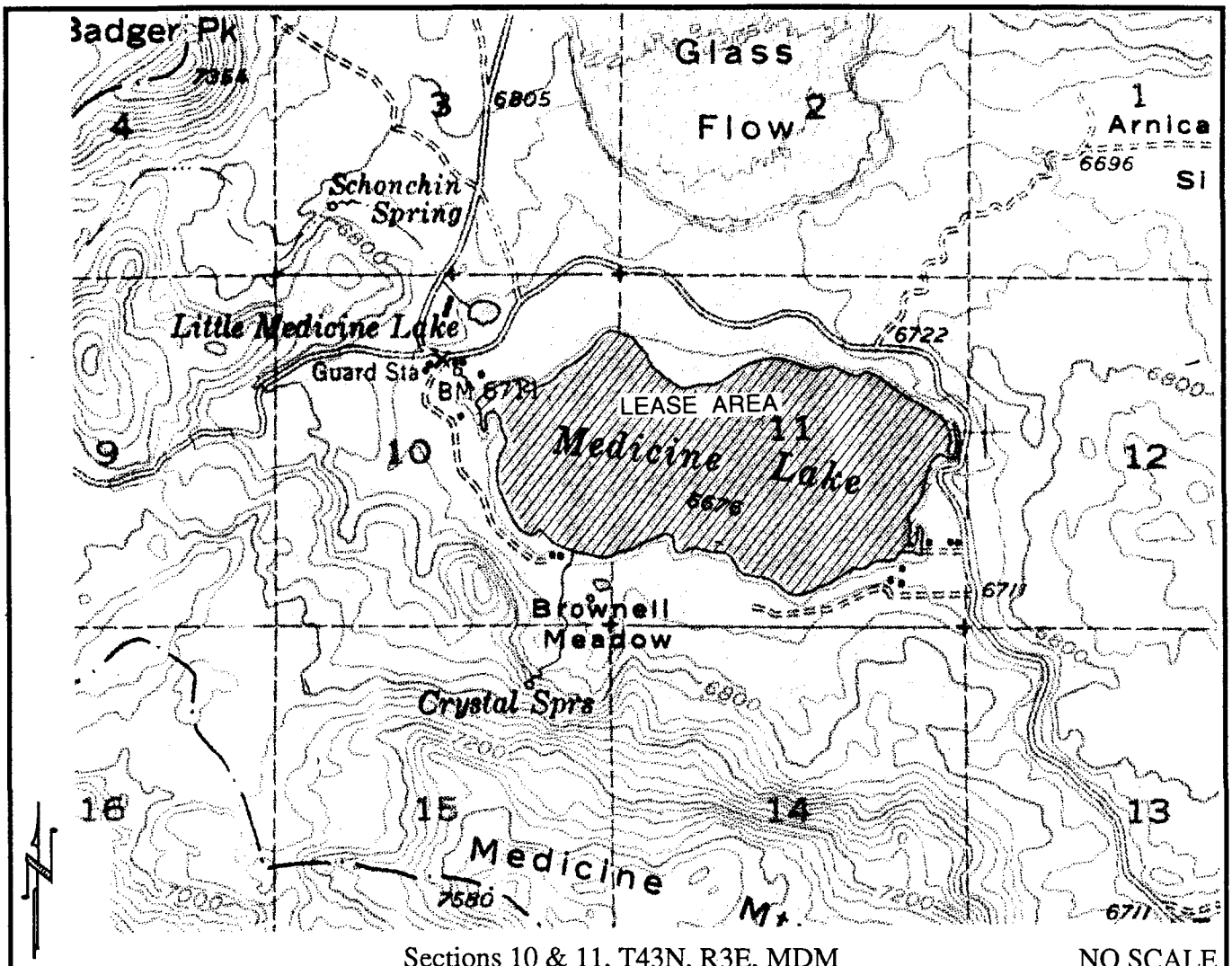
IT IS RECOMMENDED THAT THE COMMISSION:

1. FIND THAT THE ENVIRONMENTAL DOCUMENT FOR THE GLASS MOUNTAIN UNIT GEOTHERMAL EXPLORATION PROJECT (EA/IS, EA#CA027-EA95-06, SCH. #95041056) WAS PREPARED FOR REVIEW AS BOTH AN ENVIRONMENTAL ASSESSMENT AND AS AN INITIAL STUDY, AND SUBSEQUENTLY APPROVED AS A FINDING OF NO SIGNIFICANT IMPACT BY THE BUREAU OF LAND MANAGEMENT UNDER NEPA AND ADOPTED AS A MITIGATED NEGATIVE DECLARATION BY THE COUNTY OF SISKIYOU'S AIR POLLUTION CONTROL DISTRICT PURSUANT TO THE REQUIREMENTS OF THE CEQA, AND THAT THE STATE LANDS COMMISSION HAS REVIEWED AND CONSIDERED THE INFORMATION THEREIN.

2. FIND THAT THIS ACTIVITY WILL NOT INVOLVE LANDS IDENTIFIED AS POSSESSING SIGNIFICANT ENVIRONMENTAL VALUES PURSUANT TO PUBLIC RESOURCES CODE SECTIONS 6370, ET. SEQ.

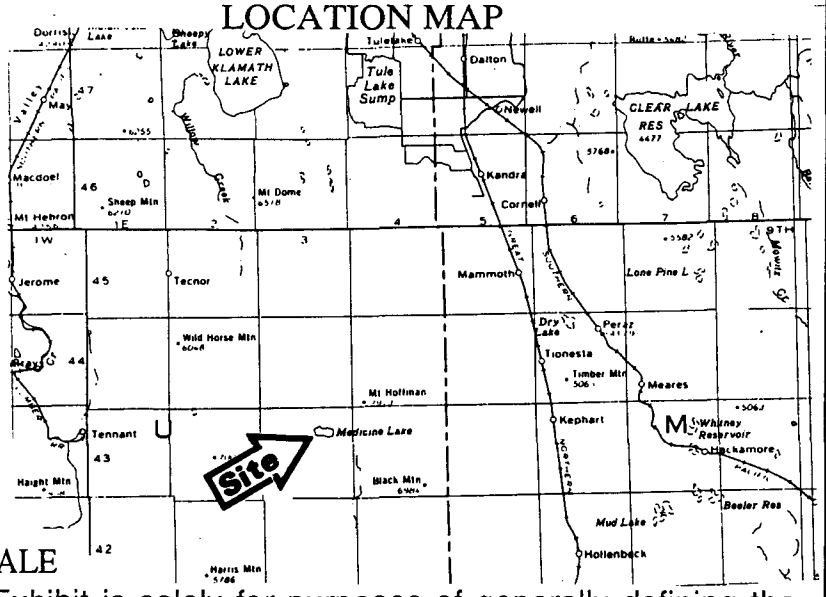
3. AUTHORIZE THE ISSUANCE OF A NEGOTIATED SUBSURFACE (NO SURFACE USE) GEOTHERMAL RESOURCES LEASE TO CALIFORNIA ENERGY GENERAL CORPORATION FOR A PRIMARY TERM OF TEN YEARS, EFFECTIVE JULY 1, 1996, IN ACCORDANCE WITH PUBLIC RESOURCES CODE SECTIONS 6901 AND 6905.

4. AUTHORIZE CALIFORNIA ENERGY GENERAL CORPORATION TO SUBMIT THE JOINDER AGREEMENT TO COMMIT THIS LEASE TO THE GLASS MOUNTAIN UNIT NO LATER THAN SEPTEMBER 30, 1996.



Sections 10 & 11, T43N, R3E, MDM NO SCALE

LOCATION MAP



NO SCALE

This Exhibit is solely for purposes of generally defining the lease premises, and is not intended to be, nor shall it be construed as a waiver or limitation of any State interest in the subject or any other property.

EXHIBIT "A"

W 40722

Geothermal Lease

Medicine Lake

SISKIYOU COUNTY

CALENDAR PAGE 505

MINUTE PAGE 001988

PROJECT:	GLASS MTN.
SUBS:	3.1.1
DATE:	
W.G. DIST:	Y (N)
COPIES:	

Glass Mountain Unit Geothermal Exploration Project

Environmental Assessment/Initial Study

EA #CA027-EA95-06

SCH #95041056

Leases CA-12367, CA-12370, CA-12371
CA-12372, CA-1224, CA-2500

August 1995

NEPA Lead Agency

U.S. Department of the Interior, Bureau of Land Management
Susanville District, Alturas Resource Area
708 West 12th Street
Alturas, California 96101

Surface Managing Agency

U.S. Department of Agriculture, Forest Service
Modoc National Forest
800 West 12th Street
Alturas, California 96101

CEQA Lead Agency

Siskiyou County Air Pollution Control District
525 South Foothill Drive
Yreka, California 96097

CALENDAR PAGE	506
MINUTE PAGE	001989

EXHIBIT "B"

Finding of No Significant Impact (FONSI)
Glass Mountain Unit Geothermal Exploration Project
Environmental Assessment/Initial Study

EA NO. CA027-EA95-06

The Department of the Interior, Bureau of Land Management (BLM), as lead federal agency, has reviewed the attached EA for Glass Mountain Unit Geothermal Exploration Project, which was prepared in accordance with the National Environmental Policy Act (NEPA). The EA has assessed the environmental effects of the proposed action (Alternative A) and other alternatives, including the "No Action" alternative. The EA documents that implementation of the proposed action with the identified mitigation measures will not result in significant environmental effects to the biological, physical or social/cultural environment. I conclude that this proposed action is not a major federal action and that preparation of an Environmental Impact Statement pursuant to Section 102(2)(c) of the NEPA is not required.

Consistency Statement:

Implementation of the proposed Action is consistent and tiers to the Modoc National Forest Land and Resource Management Plan (November 1991) and Supplemented Environmental Assessment for Geothermal leasing of National Forest System lands in the Glass Mountain Known Geothermal Resource Area, September, 14, 1994.

Reviewed by: _____ Environmental Coordinator/BLM — Date 8/25/95

Reviewed by: _____ Environmental Coordinator/USFS — Date 8/25/95

Approved by: _____ Area Manager BLM — Date 8/25/95

Attachments:

EA CA027-EA95-06
Appendix D, EA CA027-EA95-06

CALENDAR PAGE	507
MINUTE PAGE	001990

DECISION RECORD
Glass Mountain Unit Geothermal Exploration Project
Environmental Assessment/Initial Study

EA NO. CA027-EA95-06

DECISION: It is my decision to approve the proposed action of the Glass Mountain Unit Geothermal Exploration Project as evaluated in the attached Environmental Assessment (EA)NO. CA027-EA95-06. Mitigation measures identified for the proposed action in the EA have been formulated into conditions of approval as listed in Appendix C.

SUMMARY of PROPOSED ACTION: California Energy General Corporation (CEGC), as Unit Operator of the Glass Mountain Federal Geothermal Unit (14-080001-18160), has submitted a Plan of Operation (POO) for exploratory geothermal drilling within the Glass Mountain Known Geothermal Resource Area (KGRA) on the Federal Geothermal Leases CA-12367, CA-12370, CA-12371, CA-12372, CA-1224 and CA-2500). The action will occur on Federal lands which are under are management by the Modoc and Shasta-Trinity National Forests.

CEGC proposes to drill up to 5 exploratory geothermal temperature core holes (TCH) wells and to drill, complete, and test deep (production size) exploration wells at five well pads within the KGRA. At least 2 wells will be drilled at each of the five exploration well pads. For a more detailed description of the action see the attached EA.

RATIONAL: The decision will not cause any undue or unnecessary environmental degradation and is consistent with the Modoc National Forest Land and Resource Management Plan (November 1991) and tiers to the Supplemented Environmental Assessment for Geothermal leasing of National Forest System lands in the Glass Mountain Known Geothermal Resource Area, September, 14, 1994.

The proposed action, when implemented with the appropriate mitigation measure will have "No Effect" on any listed or candidate threaten and endangered species.

The Modoc National Forest has assisted in the preparation of the EA and has recommended approval of the proposed action with the incorporation of the mitigation and compliance items, found in Appendix C.

MITIGATION AND MONITORING:

1. The mitigation and monitoring plan (Appendix C) has been developed for this project and is incorporated into this decision.

CALENDAR PAGE	508
MINUTE PAGE	001991

2. Road access and well pad construction at well 46-32 shall not commence until drilling at site 28-32 has verified that a potentially commercial geothermal source exist at the well site.

3. Drilling at 15-15TGH shall not begin prior to August 15th.

4. Vehicular traffic associated with the expoloration activities shall not use the roads within the Lava Beds National Monument (LBNM).

PUBLIC REVIEW AND COMMENT:

The EA and Draft Finding of No Significant Impact (FONSI) for the proposed action were distributed for public review from April 24, 1995 to May 24, 1995, and comments were received during the public review period. These comments were considered before approving the proposed action (Alternative A). Comment letters and responses to these comments are included as Appendix D of the EA.

Approved by: Ted Burns
Alturas RA Area Manager

8/25/95
Date

Attachments:
EA CA027-EA95-06
FONSI for CA027-EA95-06

CALENDAR PAGE	509
MINUTE PAGE	001992

AIR POLLUTION CONTROL OFFICER:
James R. Massey, Jr.

525 SO. FOOTHILL DR.
YREKA, CALIFORNIA 96097
PHONE: (916) 842-8029

FAX: (916) 842-6690

County of Siskiyou

COUNTY AIR POLLUTION CONTROL BOARD:
(BOARD OF SUPERVISORS, EX-OFFICIO)

AIR POLLUTION SPECIALIST
PATRICK J. GRIFFIN

AIR POLLUTION CONTROL DISTRICT

NEGATIVE DECLARATION

Glass Mountain Unit Geothermal Exploration Project
State Clearinghouse No. 95041056

This Negative Declaration for the proposed Glass Mountain Unit Geothermal Exploration Project has been prepared pursuant to the California Environmental Quality Act (Division 13 of the California Public Resources Code) and the State CEQA Guidelines (Section 15000 *et seq.*).

PROJECT DESCRIPTION: California Energy General Corporation (CEGC), as Unit Operator of the Glass Mountain Federal Geothermal Unit (14-08-0001-18160), has proposed to implement a Plan of Operation (POO) for exploratory geothermal drilling within the Glass Mountain Known Geothermal Resource Area (KGRA) in the Medicine Lake Highlands, on the Modoc and Shasta-Trinity National Forests in Siskiyou County, California. The proposed project would occur on U.S. Bureau of Land Management (BLM) geothermal lease lands (Federal Geothermal Leases CA-12367, CA-12370, CA-12371, CA-12372, CA-1224, and CA-2500).

DETERMINATION: The attached Initial Study (IS) has been prepared for the proposed project. On the basis of the IS, the Siskiyou County Air Pollution Control District (APCD), as lead agency, has determined that implementation of the proposed project (Alternative A) with identified mitigation measures would not have a significant adverse impact on the environment for the following reasons:

- There would be no significant effect on geology, soils, or unique geologic features from implementation of the project. Potential erosion effects would be mitigated by engineering practices, and well pads would be located at a sufficient distance from unique geologic features in the area to avoid potential effects.
- The project would not affect surface or groundwater resources in the area. Mitigation would ensure that Paynes Springs would not be adversely affected.
- The project would not affect identified cultural resources and would not interfere with traditional Native American uses in the region. Mitigation is defined in the event that previously unidentified resources are discovered during construction activities.
- The project would not significantly affect vegetation or wildlife. Mitigation would be implemented where feasible to avoid conifer species that could be used by wildlife. Removal of potential habitat for the northern spotted owl, northern goshawk, and American marten would not result in significant impacts to these species, and mitigation is proposed to ensure no effect to these species. Mitigation is also proposed to minimize disturbance of general wildlife habitat in the vicinity.
- The project would not result in releases of any gases (including hydrogen sulfide (H_2S)) that would exceed standards, result in nuisances, or pose a human health hazard. Project emissions would not result in the exceedance of state or federal ambient air quality standards. Fugitive dust emissions would be controlled by watering during construction.

CALENDAR PAGE	510
MINUTE PAGE	001993

- Noise from the project would not significantly affect sensitive noise receptors (e.g., campgrounds and private residences near Medicine Lake). Noise mufflers would be used on project equipment.
- The project would not significantly affect long-range or short-range views, and would be consistent with existing land uses, leases, policies, and plans. Mitigation is proposed to avoid conflicts with recreational users and traffic using roads in the Medicine Lake area. The project would not have a significant effect on population, employment, housing, or property values.

The IS and Draft Negative Declaration for the proposed project were distributed for public review from April 24, 1995 to May 24, 1995, and comments were received during the public review period. These comments (along with the proposed Negative Declaration) were considered by the Siskiyou County APCD before approving the proposed project. Comment letters received during the public review period and responses to these comments are included as Appendix D of the IS.

Patrick J. Griffin

Patrick J. Griffin
Air Pollution Control Specialist
Siskiyou County Air Pollution Control District

7-31-95
Date

Glass Mountain Unit Geothermal Exploration Project

Environmental Assessment/Initial Study

EA #CA027-EA95-06

SCH #95041056

Leases CA-12367, CA-12370, CA-12371
CA-12372, CA-1224, CA-2500

August 1995

NEPA Lead Agency

U.S. Department of the Interior, Bureau of Land Management
Susanville District, Alturas Resource Area
708 West 12th Street
Alturas, California 96101

Surface Managing Agency

U.S. Department of Agriculture, Forest Service
Modoc National Forest
800 West 12th Street
Alturas, California 96101

CEQA Lead Agency

Siskiyou County Air Pollution Control District
525 South Foothill Drive
Yreka, California 96097

Glass Mountain Unit
Geothermal Exploration Project
Environmental Assessment/Initial Study

Table of Contents

Appendices

List of Tables

List of Figures

Glossary of Acronyms

ACRONYM	DEFINITION
AAQS	Ambient Air Quality Standard
AIRFA	American Indian Religious Freedom Act
APCD	Air Pollution Control District
ATC	Authority to Construct
BEMA	Bald Eagle Management Area
BLM	U.S. Department of the Interior, Bureau of Land Management
BMP	Best Management Practices
BOP	Blow-Out Preventer
BPA	Bonneville Power Administration
CA	California
CAA	Clean Air Act
Cal EPA	California Environmental Protection Agency
CARB	California Air Resources Board
CEGC	California Energy General Corporation
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
cm/sec	Centimeter per Second
CO	Carbon Monoxide
CVRWQCB	Central Valley Regional Water Quality Control Board
d/d	Dead and Downed
dB	Decibel
dBA	Decibels on the A-weighted Scale
dbH	Diameter at Breast Height
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
°F	Degrees Fahrenheit
FEIS	Final Environmental Impact Statement
FESA	Federal Endangered Species Act
FMRP	Freeport-McMoRan Resource Partners
GHC	Good Hiding Cover
GRO	Geothermal Resource Operational Orders
H_2S	Hydrogen Sulfide
ID	Inside Diameter
IP	Interested Parties
IS	Initial Study
KGRA	Known Geothermal Resource Area
LCM	Lost Circulation Material
MF	Marginally Suitable for Foraging
MIS	Management Indicator Species
MMRP	Mitigation Monitoring and Reporting Program
mph	Miles Per Hour
MR	Marginally Suitable for Reproduction
MTC	Marginally Suitable for Thermal Cover
MW	Megawatts
NAHC	Native American Heritage Council
NEPA	National Environmental Policy Act
NRHP	National Register of Historic Places

Glossary of Acronyms (continued)

ACRONYM	DEFINITION
No.	Number
NO_2	Nitrogen Dioxide
NO_X	Oxides of Nitrogen
NTL	Notice to Lessees
NWC	Naval Weapons Center
O_3	Ozone
OD	Outside Diameter
PAI	Potentially Affected Individuals
Pb	Lead
PM_{10}	Particulate Matter Less Than 10 Microns
POO	Plan of Operation
ppm	Parts Per Million
psi	Pounds per Square Inch
PTO	Permit to Operate
PFR	Primary Forest Route
RMA	Recreation Management Area
RRA	Roadless Release Area
RV	Recreational Vehicle
SCAPCD	Siskiyou County Air Pollution Control District
SF	Suitable for Foraging
SO_2	Sulfur Dioxide
SPL	Sound Pressure Levels
SR	Suitable for Reproduction
STC	Suitable for Thermal Cover
TCH	Temperature Core Hole
TGH	Temperature Gradient Hole
USFS	U.S. Department of Agriculture, Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Department of the Interior, Geological Survey
VQO	Visual Quality Objective

EXECUTIVE SUMMARY

CALENDAR PAGE	517
MINUTE PAGE	002000

EXECUTIVE SUMMARY

Project Overview

California Energy General Corporation (CEGC), as Unit Operator of the Glass Mountain Federal Geothermal Unit (14-08-0001-18160), has proposed to implement a Plan of Operation (POO) for exploratory geothermal drilling within the Glass Mountain Known Geothermal Resource Area (KGRA) in the Medicine Lake Highlands, on the Modoc and Shasta-Trinity National Forests in Siskiyou County, California (see Figure 1.1-1). The proposed action would occur on existing U.S. Bureau of Land Management (BLM) geothermal lease lands (Federal Geothermal Leases CA-12367, CA-12370, CA-12371, CA-12372, CA-1224, and CA-2500).

Purpose and Need

The purpose of the proposed action is to investigate and determine the extent and production capacity of the geothermal resource within the lease area and determine if the resource is commercially viable. The need for the proposed action has been established by the Geothermal Steam Act of 1970, the Warren-Alquist Act of 1974, the Federal Land Policy and Management Act of 1976, the Public Utility Regulatory Policies Act of 1978, and the National Materials and Minerals Policy, Research, and Development Act of 1980.

Agency Roles

The BLM has the authority to issue leases for and make determinations on proposed geothermal activities on Federal lands, including National Forest lands. The BLM is therefore the lead Federal agency for the proposed action, and is responsible for conducting an environmental review of the proposed action pursuant to the National Environmental Policy Act (NEPA) and for approving or denying the proposed POO.

Since the proposed action is located on the Modoc and Shasta-Trinity National Forests, the U.S. Department of Agriculture, Forest Service (USFS) is the Surface Managing Agency for

the proposed action. Before the BLM can authorize any proposed geothermal activities on National Forests, the BLM must consult with the USFS and obtain USFS concurrence. The Modoc National Forest is cooperating with the BLM on behalf of the USFS and is overseeing the preparation of the environmental analysis for the proposed action.

Implementation of the proposed POO would require that CEGC obtain an Authority to Construct (ATC) permit from the Siskiyou County Air Pollution Control District (SCAPCD). The SCAPCD has assumed the role of the state lead agency, and as such is responsible for ensuring that the proposed action complies with the California Environmental Quality Act (CEQA). The Central Valley Regional Water Quality Control Board (CVRWQCB) also has permitting authority for the proposed action.

This document has been prepared as an Environmental Assessment (EA) under NEPA, and as an Initial Study (IS) under CEQA.

Environmental Issues and Concerns

Environmental issues and concerns identified through the scoping process for this EA/IS include the following:

- Effects to regional geology and sustainability of the geothermal resource
- Effects to the Medicine Lake water table and lake level
- Potential to interfere with water supply to Medicine Lake
- Native American concerns
- Effects to vegetation from construction of pads and roads
- Effects to threatened and endangered animal species
- Potential health risks from drilling activities (including the release of gases)
- Wind dispersion of drilling emissions
- Noise from operations
- Preservation of scenic resources
- Potential for conflict with tourism and recreation at Medicine Lake
- Effects on area roads
- Effects on property values and local communities
- Potential for local jobs and use of labor from other areas
- Restoration of pads and roads after the project is completed
- Effects from transmission lines and pipelines
- Potential for large-scale development and siting of a power plant

Alternatives, Including the Proposed Action

ALTERNATIVE A—PROPOSED ACTION

In the proposed POO, CEGC proposes to drill of up to five exploratory geothermal temperature core hole (TCH) wells and to drill, complete, and test deep (production size)

exploration wells at five well pads within the Glass Mountain KGRA (see Table 1.1-1 and Figure 1.1-2). At least two wells would be drilled at each of the five exploration well pads. The TCH wells would be drilled to a maximum depth of 5,500 feet in order to measure temperature and define lithology. The exploration wells would be drilled to depths of approximately 9,000 feet. These wells have been sited based on regional structural geology and the results of temperature analyses at existing TCH wells that have already been drilled within the Unit Area. Drilling would begin in 1995 and be completed by 1997.

The proposed well sites have been selected to minimize the amount of new surface disturbance. With the exception of well pad 46-32, all well pads would be at least partially located on old log landings, logging roads, or in previously clear-cut areas. TCH well pads would measure approximately 60 feet by 100 feet, and exploration well pads would measure approximately 400 feet by 600 feet. Construction of approximately 2,600 feet of new access roads and improvement to about 8,150 feet of existing access roads would be required to provide vehicle access to the drill sites. Total surface disturbance to construct the well pads and new access roads would be approximately 29.6 acres.

ALTERNATIVE B—ELIMINATION OF WELL PADS NEAR MEDICINE LAKE

Alternative B would involve drilling activities at all well pads identified in the POO with the exception of TCH wells 42-13TCH and 15-15TCH (see Figure 1.1-2). These wells would not be drilled due to public concern over the proximity of the well pads to Medicine Lake. In addition, the old logging skid road to well 42-13TCH would not be improved. All drilling and testing activities and procedures at the other three TCH wells and the five exploration well pads would be the same as described for the proposed action.

ALTERNATIVE C—ELIMINATION OF WELL PADS NEAR MOUNT HOFFMAN

Alternative C would involve drilling activities at all well pads identified in the POO with the exception of exploration well pads 18-32 and 46-32 (see Figure 1.1-2). Exploration wells at these pads would not be drilled due to their suitability as habitat for several species and their location within the Mount Hoffman Roadless Release Area (RRA). In addition, the new access road to well pad 46-32 would not be constructed, and the existing spur road to well pad 18-32 would not be improved. All drilling and testing activities and procedures at the other three exploration well pads and the five TCH well locations would be the same as described for the proposed action.

ALTERNATIVE D—NO ACTION

Under Alternative D (referred to as the "No Action" alternative), the proposed POO would not be implemented. Exploratory drilling and testing of the geothermal resource associated with the POO would not occur.

Environmental Consequences

The following is a summary of the expected environmental effects of the proposed action. For a complete description of all potential effects (as well as proposed mitigation measures), please see Chapter 4 of this document. Section 4.13, Summary of Mitigation

Measures, also identifies the mitigation measures that would be applicable to the proposed action, and a Mitigation Monitoring and Reporting Program (MMRP) for the proposed action is provided in Appendix C.

GEOLOGY AND SOILS

The proposed project may result in a minor increase in erosion at the proposed well pads and access roads. Erosion would be mitigated by engineering practices (see Section 4.13). Construction of pads and roads would result in minor changes in topography, although most of the proposed pads are located on areas that have been previously logged. The site of well pad 58-6 is located at a sufficient distance from the Glass Mountain obsidian flow to avoid effects to this flow (see Section 4.13).

Well blow-outs and the associated effect on project workers are a potential but unlikely hazard of well drilling. Proper material handling would be implemented by CEGC to minimize health risks.

HYDROLOGY

Proposed TCH drilling would require approximately 3,000 to 5,000 gallons of water per day and would take from 25 to 60 days to drill. Exploratory wells would require approximately 9,000 gallons per day and would take from 60 to 90 days to drill; up to 40,000 gallons could be required in lost circulation zones. Water would be obtained from existing sources and would not result in significant depletion of surface or groundwater resources.

Casing and drilling procedures would eliminate the possibility of groundwater contamination from drilling or testing the geothermal resource. The potential for the proposed action to adversely affect Paynes Springs is considered unlikely (see Section 4.13).

CULTURAL RESOURCES

The proposed project would not affect identified cultural or archaeological resources. Mitigation is defined in the event that previously unidentified resources are discovered during construction activities (see Section 4.13).

Native Americans have expressed concerns about the proposed project and the potential to interfere with traditional Native American uses in the region. No specific conflicts with project activities have been identified and no significant impacts are expected to occur due to the limited duration of proposed construction, drilling, and testing activities. Mitigation is proposed to reduce or eliminate potential effects to Native Americans (see Section 4.13).

BIOLOGY

Vegetation

Total surface disturbance at the proposed action would be approximately 29.6 acres. Given the limited acreage of vegetation that would be cleared for the proposed action, the fact

that 9 of the 10 proposed well pads would be at least partially located on previously logged or cleared areas, and the reclamation that would occur at these facilities, the proposed action would not significantly affect vegetation. Mitigation is proposed to avoid impacts to vegetation from erosion (see Section 4.13).

Construction for well pads and roads would not remove old growth forest but some isolated old growth trees would be removed. CEGC would avoid conifer species over 14 inches dbh where feasible (see Section 4.13).

Geothermal fluids could be deposited on surrounding vegetation during exploration well testing. No significant vegetation effects are expected from this deposition during testing.

Wildlife

The proposed project would result in the loss of habitat that is or may be suitable for sensitive species including:

- Northern spotted owl
- Northern goshawk
- American marten

The expected loss of habitat from implementation of the proposed action would not result in significant impacts to any of the species. Mitigation is proposed to eliminate, reduce, or compensate for impacts to these species (see Section 4.13).

The proposed action would result in the loss of habitat at the well pads and access road corridors for general wildlife species, as well as potential reductions in the use of adjacent habitats. The expected loss of habitat would not result in significant impacts to any general wildlife species. Although some animals may avoid habitats in the vicinity of the proposed action, any avoidance would be temporary. Mitigation is proposed to minimize disturbance of general wildlife habitat in the vicinity (see Section 4.13).

AIR QUALITY

Proposed geothermal drilling and testing would not result in releases of any gases (including hydrogen sulfide (H_2S)) that would exceed standards, result in nuisances, or pose a human health hazard. Emissions during well construction, drilling, and testing would not result in the exceedance of state or federal ambient air quality standards. Fugitive dust emissions will be controlled by watering during construction.

NOISE

Noise from well construction, drilling, and testing would not significantly affect sensitive noise receptors, such as campgrounds and private residences near Medicine Lake. Noise mufflers will be used on project equipment.

VISUAL RESOURCES

The proposed well pads and roads be visible at certain vantage points. However, the project elements would have a minimal visual impact to long-range views due to their small size and the previous logging disturbance that exists at the sites and throughout the vicinity. Short-range views would also not be significantly affected. The well pads and roads would not be visible from Medicine Lake.

LAND USE, RECREATION, AND TRANSPORTATION SYSTEMS

The proposed action would be consistent with existing land uses, leases, policies, and plans. The well pads and access roads would be noticeable to recreational users throughout the area, but would not result in adverse effects on recreational uses in the Forest. Mitigation is proposed to avoid conflicts with recreational users accessing Medicine Lake (see Section 4.13).

Project roads would be gated and would not open new access. Potential conflicts with traffic around Medicine Lake were identified; proposed mitigation would eliminate conflicts (see Section 4.13).

SOCIOECONOMICS

The proposed project would result in short-term, minor increases in populations and revenues to local businesses by the drilling crews. The project would also present employment opportunities for pad and road construction. The proposed action would generate approximately $1,125,000 to $1,752,500 in salaries for project employees, and would not adversely affect property values of the homes at Medicine Lake.

Unavoidable Adverse Impacts

Based upon the analysis conducted for this document, a number of unavoidable adverse effects were identified. Those impacts that cannot be avoided include:

- Surface disturbance of 29.6 acres, changes in topography, and increased erosion
- Exposure of workers to the potential for natural seismic and volcanic hazards during well construction, drilling, and testing
- Removal of scattered old growth trees and loss of potential habitat for sensitive wildlife species
- Release of air emissions during well construction, drilling, and testing
- Increase in noise during well construction, drilling, and testing
- Views of the proposed action from long-range and short-range viewpoints
- Reduction in the quality of recreation experience in the vicinity of the proposed action during well construction, drilling, and testing
- Temporary increase in traffic from construction-related and operational activities
- Temporary increase in population and employment in the vicinity of the proposed action

Each of these effects is discussed in detail in Sections 4.2 through 4.10. None of these effects is considered to be significant.

Cumulative Impacts

Two cumulative projects have been identified in the vicinity of the proposed action: the Calpine Fourmile Hill Exploration Program, and the Tuscarora Gas Pipeline. These projects, in conjunction with the proposed action, would be expected to produce cumulative impacts related to geology and soils, hydrology, biology, visual resources, recreation, transportation systems, and socioeconomics. However, none of these impacts would be considered cumulatively significant.

1: INTRODUCTION

1: INTRODUCTION

1.1 Project Overview

California Energy General Corporation (CEGC), as Unit Operator of the Glass Mountain Federal Geothermal Unit (14-08-0001-18160), has proposed to implement a Plan of Operation (POO) for exploratory geothermal drilling within the Medicine Lake Highlands on the Modoc and Shasta-Trinity National Forests in Siskiyou County, California (see Figure 1.1-1). All proposed geothermal drilling would occur within the Glass Mountain Known Geothermal Resource (KGRA). The Federal geothermal leases in the Glass Mountain KGRA have been organized into a Federal Unit Area, and CEGC has been designated the Unit Operator. The proposed action would occur on Federal lands that have been leased by the U.S. Bureau of Land Management (BLM) to CEGC or Freeport-McMoRan Resource Partners (FMRP) for the exploration, development, production, and utilization of geothermal resources.

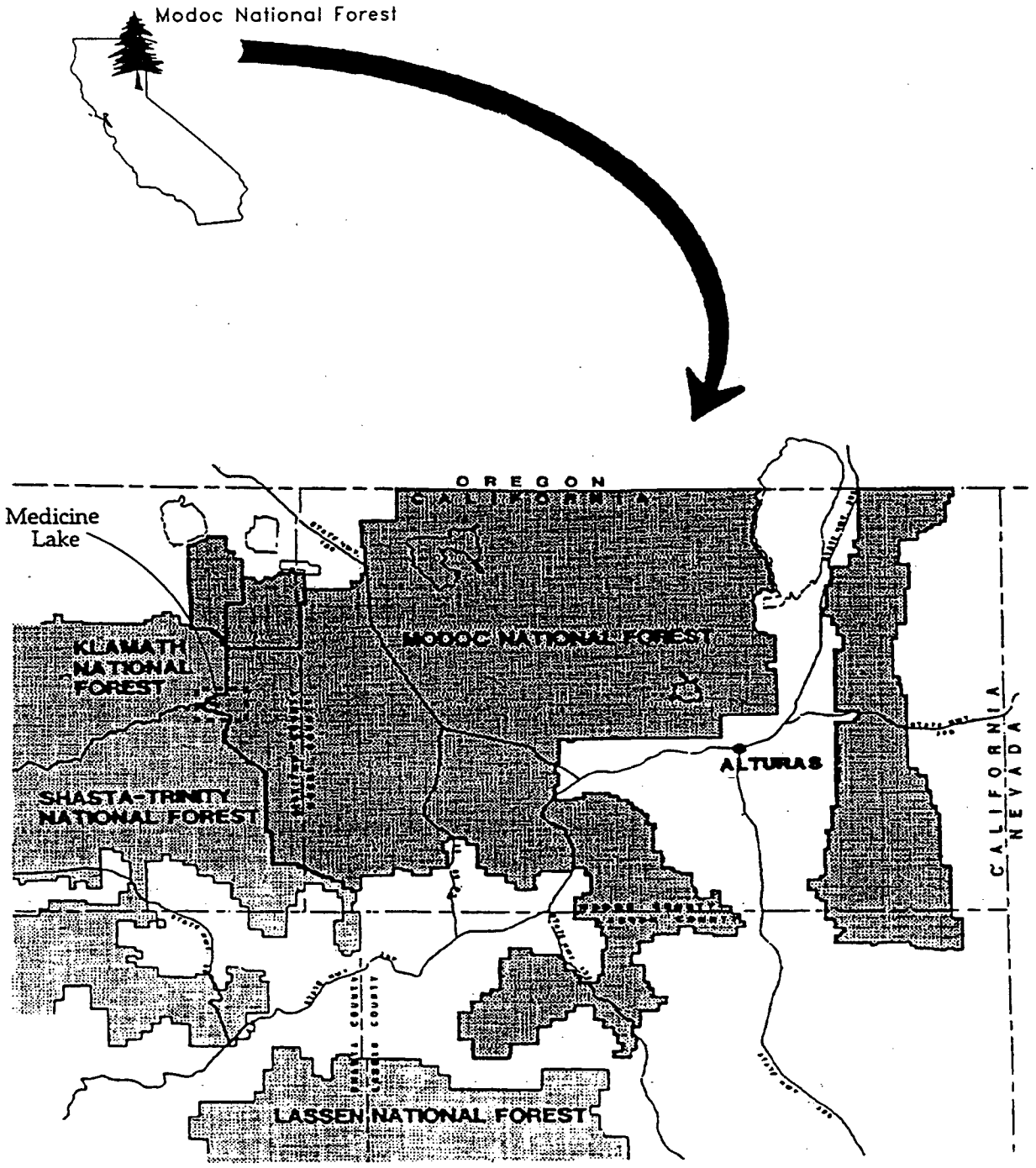
Approval of the proposed action would allow the drilling of up to five exploratory geothermal temperature core hole (TCH) wells and the drilling, completion, and testing of deep (production size) exploration wells at five well pads within the Glass Mountain Unit Area beginning in the summer of 1995. The designations for each of the well pads are presented in Table 1.1-1. The locations of all proposed well pads are shown in Figure 1.1-2.

Table 1.1-1: Proposed Temperature Core Hole and Exploration Well Pad Designations

Temperature Core Holes	Production Test Wells
34-8TCH	18-32
42-13TCH	46-32
11-24TCH	58-6
15-15TCH	56-18
63-20TCH	13-18

SOURCE: CEGC 1994

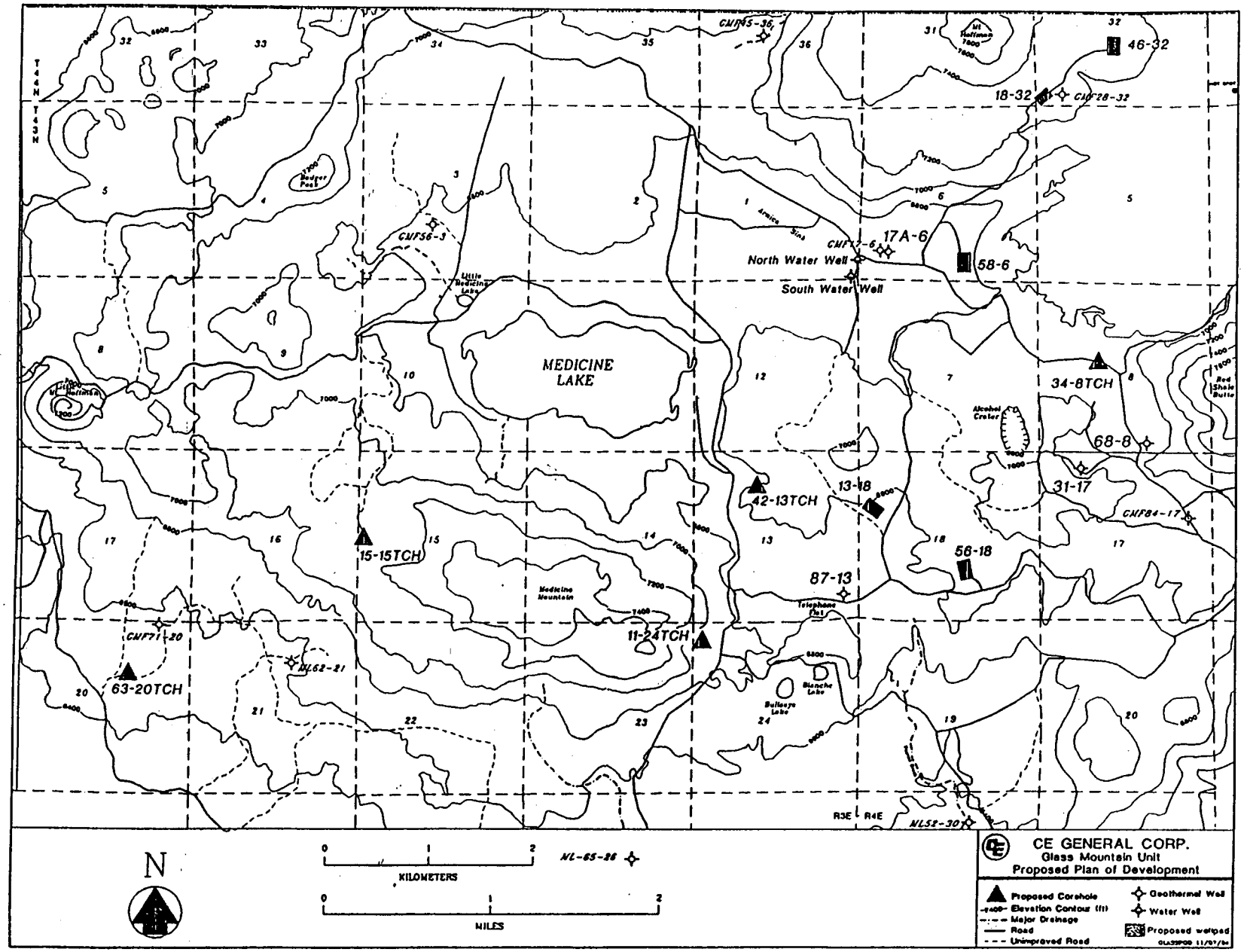
Figure 1.1-1: Regional Area Map



SOURCE: USFS 1991b

CALENDAR PAGE 527
MINUTE PAGE 06/2010

Figure 1.1-2: Temperature Core Hole and Production Test Well Locations



SOURCE: CEGC 1994

The TCH wells would be drilled to a maximum depth of 5,500 feet in order to measure temperature gradients and define lithology. The exploration wells would be drilled to depths of approximately 9,000 feet. The deep wells have been sited based on regional structural geology and on the results of temperature analyses at existing TCH wells that have already been drilled within the Unit Area.

1.2 Purpose and Need

The purpose of the proposed action is to:

- Investigate the temperature gradient in the lease areas and examine rock formations at depth
- Determine the extent and production capacity of the geothermal resource in these lease areas
- Determine if the geothermal resource in these lease areas is commercially viable and warrants further deep exploration drilling

The need for the proposed action has been established by the U.S. Congress in the Geothermal Steam Act of 1970 and by the California legislature in the Warren-Alquist Act of 1974, both of which encouraged geothermal energy development as a means to diversify energy supplies. In addition, the Federal Geothermal Leases issued by the BLM require diligent exploration. Other acts (including the Federal Land Policy and Management Act of 1976, the Public Utility Regulatory Policies Act of 1978, and the National Materials and Minerals Policy, Research, and Development Act of 1980) also identify the need to develop alternate energy resources.

1.3 Agency Roles

BUREAU OF LAND MANAGEMENT

At the Federal level, the Geothermal Steam Act of 1970 gives the BLM the authority to issue leases for and make determinations on all geothermal activities proposed to be conducted on Federal lands, including National Forest lands. The BLM is therefore the lead Federal agency for the proposed action.

The POO has been submitted by CEGC to the Susanville District, Alturas Resource Area office of the BLM for review and approval. The BLM is responsible for conducting an environmental review of the proposed project pursuant to the National Environmental Policy Act (NEPA) and for approving, approving with modifications, or denying the proposed POO.

FOREST SERVICE

The proposed project is located on the Modoc and Shasta-Trinity National Forests. The U.S. Department of Agriculture, Forest Service (USFS) is therefore the Surface Managing Agency for the proposed action. The BLM and Region V of the USFS have entered into a Memorandum of Understanding (MOU) for coordinating the processing of proposed

geothermal pre- and post-lease actions on National Forests (BLM and USFS 1989). Before the BLM can authorize any proposed geothermal activities on National Forests, the BLM must consult with the USFS to obtain USFS concurrence. The USFS is responsible for identifying mitigation measures and making recommendations to the BLM for proposed activities.

The USFS, Modoc National Forest is cooperating with the BLM and is overseeing the preparation of this environmental analysis. This environmental document includes the recommendations of the USFS regarding the proposed action.

The POO was submitted by CEGC to the USFS Modoc National Forest Supervisor's office for their information. The Modoc National Forest has reviewed the proposed project and participated in the preparation of this environmental document. The project includes conditions prescribed by the Modoc and Shasta-Trinity National Forests; however, the USFS does not issue a decision on this proposed action. The USFS may issue permits to CEGC for off-lease activities such as well and road use.

SISKIYOU COUNTY AIR POLLUTION CONTROL DISTRICT

Implementation of the proposed POO would also require that CEGC obtain applicable permits from the local air district. The proposed project would include the emission of geothermal steam to the atmosphere during drilling and testing; therefore, the Siskiyou County Air Pollution Control District (SCAPCD) would have the authority to issue an Authority to Construct (ATC) permit for the proposed action. The SCAPCD has assumed the role of the state lead agency, and as such is responsible for ensuring that the proposed action complies with the California Environmental Quality Act (CEQA). This environmental document will be evaluated by the SCAPCD to determine whether to issue a permit to CEGC for the proposed action.

CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD

The Central Valley Regional Water Quality Control Board (CVRWQCB) has jurisdiction over waste discharge to land and is responsible for issuing permits for discharging fluids to well pad sumps and injection of geothermal fluids. In 1991, the CVRWQCB issued a permit to the USFS and Union Oil Company of California (Unocal) for geothermal exploration on leases within the Glass Mountain KGRA (see Section 1.4, Project History). The leases addressed in the permit have since been transferred to CEGC. The issued permit covers the area of the proposed action. CEGC proposes the same geothermal activities for the area covered by the CVRWQCB permit as those proposed by the USFS and Unocal. CEGC has therefore requested that the CVRWQCB permit be reissued to CEGC for the proposed action. The CVRWQCB will use this environmental document to facilitate their review of CEGC's request for a reissued permit.

NEPA/CEQA

Since implementation of the POO would require approvals from both Federal and local agencies, the proposed action is subject to environmental review pursuant to NEPA and CEQA. This document has therefore been prepared as both an Environmental Assessment

(EA) in order to meet the requirements of NEPA, and as an Initial Study (IS) under CEQA. An Initial Study Checklist is included in this EA/IS as Appendix A.

This environmental document has been prepared by a third-party consultant under the direction of the lead and surface managing agencies, in accordance with BLM guidelines (see Chapter 5).

1.4 Project History

PREVIOUS GEOTHERMAL ACTIVITIES

The proposed action would be located within the Glass Mountain Unit Area (see Figure 1.4-1), which was 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. At the time that the Unit Agreement was approved, Unocal was designated as the Unit Operator. Other major lease holders in the Unit Area were Occidential Geothermal, Inc. and Phillips Petroleum Company.

Subsequent to approval of the Unit Agreement in 1982, there have been several changes in the geothermal exploration companies interested in exploring the geothermal resource within the Glass Mountain Unit Area. By 1988, the primary lease holders within the Unit Area were Unocal and Freeport-McMoRan Resource Partners (FMRP). In 1993, CEGC acquired the Unocal leases within the Unit Area and was designated the Unit Operator. In 1994, FMRP designated Calpine Corporation as its agent for geothermal exploration at the Unit Area (FMRP still holds the leases). Current lease holdings within the KGRA are illustrated in Figure 1.4-1.

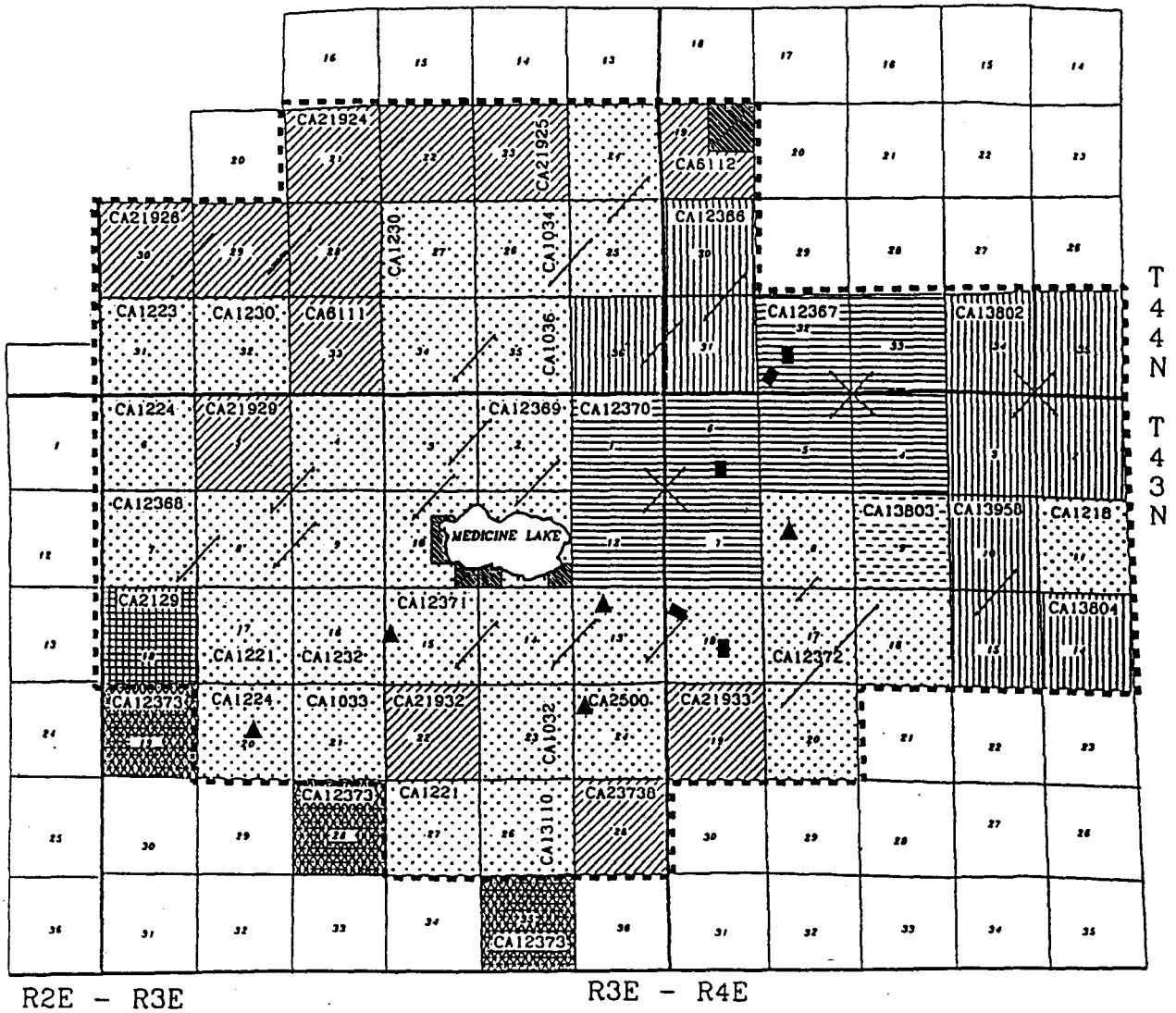
Extensive investigations and geophysical surveys of the geothermal resource have been conducted within the Glass Mountain Unit Area since the Unit Agreement was approved in 1982. A total of 24 TCH wells were drilled in the Unit Area between 1981 and 1984 (the first phase of exploration). These wells were drilled by Unocal, Phillips Petroleum, and Occidential Geothermal, and were used to measure the temperature gradient in the Unit Area.

Based on the results of the temperature gradient drilling, drilling of deep exploration test wells (the second phase of exploration) was initiated in 1984 when Phillips Petroleum and Occidential Geothermal drilled a deep exploration test well at well pad 17A-6 (see Figure 1.1-2). Unocal drilled three additional deep exploration test wells between 1985 and 1991 (well pad 68-8 was drilled in 1985, well pad 31-17 was drilled in 1988, and well pad 87-13 was drilled in 1989 and deepened in 1991).

PREVIOUS ENVIRONMENTAL DOCUMENTATION

In 1981, the BLM proposed to issue several geothermal leases within the Glass Mountain KGRA for the purpose of exploring, developing, and utilizing the geothermal resource

Figure 1.4-1: Glass Mountain KGRA Lease Holdings



	CEGC 100%
	CEGC 50% FMRP 50%
	CEGC 25% FMRP 75%
	CEGC 62.5% FMRP 37.5%
	FMRP 100%
	CLJV
	Quadra Geo et al
	Fee—Unleased
---	Unit Boundary
CA 1221	Lease Numbers

▲ Proposed Core Holes

■ Proposed Exploration Wells

CEGC: California Energy General Corporation

FMRP: Freeport-McMoRan Resource Partners

CLJV: China Lake Joint Venture

N

0 1 2 3 4 MILES

SOURCE: CEGC 1994

GMU EA/IS

CALENDAR PAGE 532 1-7

MINUTE PAGE 002015

within the KGRA. As part of the authorization process for this leasing, the BLM and the USFS jointly prepared and issued an EA for the "casual use and exploration" of the geothermal resource within the KGRA (BLM and USFS 1981). In 1984, the EA was supplemented to analyze additional potential geothermal leases from expansion of the KGRA and to address the potential environmental effects associated with exploration, development, production, and utilization of the geothermal resource (BLM and USFS 1984). The leases that were issued explicitly provide for the exploration, development, production, and utilization of the leases. The leases that the proposed action is located on also carry special stipulations that CEGC must comply with prior to implementation of any proposed POO (see the discussion of geothermal lease stipulations in Sections 3.9 and 4.9 of this document).

In 1991, the USFS prepared a Land and Resource Management Plan for the Modoc National Forest (USFS 1991a). This Management Plan provides guidance on natural resource management activities and establishes management standards and guidelines for the Modoc National Forest. As part of the environmental review process for the Management Plan, the USFS prepared a Final Environmental Impact Statement (FEIS) that discusses the environmental consequences of the Plan and acknowledges the potential for geothermal development on the Forest (USFS 1991b).

The 1981 EA, 1984 Supplemented EA, 1991 Management Plan, and 1991 Management Plan FEIS are available for review at the USFS, Modoc National Forest Supervisor's office in Alturas, California. These documents are herein referenced and summarized where appropriate.

In 1994, Calpine Corporation (as designated agent for FMRP) proposed to drill two temperature gradient wells on Lease CA-21926. The impacts of these wells were addressed in an EA prepared by the BLM, Alturas Resource Area Office (BLM 1994).

1.5 Environmental Issues and Concerns

Prior to preparation of this EA/IS, the USFS notified responsible agencies, Native American groups, and the public of the proposed action in order to identify environmental issues to be addressed in the EA/IS. As part of the scoping process for the EA/IS, a notification letter was issued by the USFS to approximately 110 Interested Parties (IP) and Potentially Affected Individuals (PAI) on September 23, 1994. The IP/PAI letter summarized the actions proposed in the POO and requested that any comments or concerns regarding the POO be expressed in writing and submitted to the USFS by November 1, 1994.

A total of 44 responses to the IP/PAI letter were received by the USFS (see Appendix B). Of these responses, 14 contained comments addressing the POO; the remaining 30 letters were requests to be kept informed about project developments by the USFS. This EA/IS presents an analysis of the environmental consequences of the proposed POO and addresses concerns regarding the POO that were raised during the scoping process. The

following is a summary of the environmental issues that were identified through the scoping process.

GEOLOGY AND THE GEOTHERMAL RESOURCE

Of concern to the public are effects to regional geology from implementation of the proposed POO. The public also expressed concern over how the proposed action would affect the sustainability of the geothermal resource. These topics have been addressed in Section 4.2 of this EA/IS.

MEDICINE LAKE WATER TABLE AND LAKE LEVEL

The public expressed concern over how implementation of the proposed POO would affect the water table and lake level at Medicine Lake, due to the proximity of the proposed action to the lake. These topics have been addressed in this EA/IS, Section 4.3.

MEDICINE LAKE WATER SUPPLY

Drilling operations under the proposed POO would require water use. The potential for the proposed action to interfere with the supply of water to Medicine Lake has therefore been identified as an environmental issue, and this topic has been addressed in Section 4.3.

NATIVE AMERICAN CONCERNS

The vicinity of the proposed POO is an area that is used by several Native American groups, primarily for spiritual and cultural heritage purposes. The USFS and BLM have conducted three meetings and one site visit with Native American groups to solicit Native American concerns regarding the proposed action. These concerns are addressed in Sections 3.4 and 4.4 of this EA/IS.

VEGETATION EFFECTS

Of concern to the public is the amount of surface disturbance from implementation of the proposed POO, and the acreage of vegetation that would be removed for construction of well pads and roads. This topic has been addressed in Sections 3.5 and 4.5 of this EA/IS.

THREATENED, ENDANGERED, AND SENSITIVE ANIMAL SPECIES

The proposed action would be located on a National Forest that provides habitat for a variety of animal species. The potential for the proposed action to affect threatened, endangered, and sensitive animal species in the project vicinity has been identified as an environmental issue. Of particular concern are proposed drilling activities at well pads that are located in more isolated areas and that provide habitat for special status animal species. This topic has been addressed in this EA/IS, Section 4.5.

POTENTIAL HEALTH RISKS

The public expressed concern over potential health risks from drilling activities that would occur under the proposed POO. Of particular concern is the potential release of gases from drilling and well testing activities, and how these gases would affect residences near Medicine Lake. This topic has been addressed in Sections 4.2 and 4.6 of this EA/IS.

WIND DISPERSION OF DRILLING EMISSIONS

Geothermal drilling under the proposed POO would emit geothermal steam to the atmosphere. The public expressed concern about the potential for these emissions to affect vegetation and the public (particularly residences near Medicine Lake) through wind dispersion of the geothermal emissions. This topic has been addressed in Sections 4.5 and 4.6 of this EA/IS.

NOISE

The public expressed concern about the level of noise that would be generated by project operations under the proposed POO, and how these noise levels would affect residences near Medicine Lake. This topic has been addressed in this EA/IS, Section 4.7.

SCENIC RESOURCE PRESERVATION

The public expressed concern about how implementation of the proposed POO would affect scenic resources in the project vicinity. This topic has been addressed in Section 4.8.

TOURISM AND RECREATION CONFLICTS

Of concern to the public is the potential for geothermal exploration activities allowed under the proposed POO to conflict with tourism and recreation at Medicine Lake. This topic has been addressed in Section 4.9 of this EA/IS.

TRANSPORTATION SYSTEMS

The public expressed concern over how implementation of the proposed POO would affect roads in the project vicinity. Specifically, the public is concerned with the maintenance of any roads to be used by traffic generated by the proposed action and the potential for winter clearance of roads in the vicinity. These topics have been addressed in Section 4.9 of this EA/IS.

EFFECTS ON PROPERTY VALUES AND LOCAL COMMUNITIES

Comments were received regarding the potential for implementation of the proposed POO to affect property values in the project vicinity (particularly residential property near Medicine Lake), as well the potential effect of implementation of the proposed project on local communities. These topics have been addressed in Section 4.10 of this EA/IS.

LOCAL JOBS AND USE OF LABOR FROM OTHER AREAS

The proposed action would generate employment in the project vicinity. Of concern to the public is how many local jobs would be created and how much of the labor force would be brought in from other areas. This topic has been addressed in Section 4.10.

PAD AND ROAD RESTORATION

The public expressed concern over how restoration of well pads and roads would occur upon completion of the proposed POO. This topic has been addressed in Chapter 2 of this EA/IS.

LARGE-SCALE/POWER PLANT DEVELOPMENT

The public expressed concern about the potential for large-scale development and siting of a power plant under the proposed POO. While CEGC believes that there are substantial geothermal resources within the Glass Mountain KGRA (based on previous exploratory drilling), it is uncertain at this time whether a commercially viable geothermal resource actually exists. Only exploratory geothermal drilling and testing is therefore proposed in the POO, and no utilization or development of the geothermal resource within the KGRA is proposed.

Since it is not reasonably foreseeable at this time that utilization or development of the geothermal resource would occur as a result of the proposed POO, this EA/IS addresses only the activities described in the POO. This approach is consistent with Section 21090.1 of the CEQA Statutes, which specifies that an exploratory geothermal project should be deemed to be separate and distinct from any subsequent geothermal field development. An analysis of geothermal activities beyond those described in the POO would be considered speculative at this time, and this topic has not been addressed in this EA/IS.

If a commercially viable geothermal resource is discovered within the Glass Mountain KGRA, utilization and development of the geothermal resource would require the preparation of separate Plans of Development and Utilization. These future plans (if warranted) would describe detailed plans for construction and operation of geothermal facilities such as a power plant, transmission lines, and a development well field. Similar to the POO, these plans would be subject to environmental review and public comment.

TRANSMISSION LINES AND PIPELINES

The public expressed concern over potential effects from development of transmission lines and pipelines under the proposed POO. The effect of installing pipelines to transport water and sump contents has been addressed in this EA/IS (see Section 4.2 and 4.5). Since transmission lines are not proposed to be installed under the POO (only exploratory geothermal drilling and testing is proposed in the POO), this topic has not been addressed in this EA/IS.

2: ALTERNATIVES, INCLUDING THE PROPOSED ACTION

2: ALTERNATIVES, INCLUDING THE PROPOSED ACTION

2.1 Alternative A—Proposed Action

LOCATION

The proposed action would be located within the Glass Mountain KGRA in the Medicine Lake Highlands, on the Modoc and Shasta-Trinity National Forests in Siskiyou County, California (see Figure 1.1-1). On the Modoc National Forest, activities would occur in the Double Head Ranger District; on the Shasta-Trinity National Forest, activities would occur in the McCloud Ranger District. Only 63-20TCH would be located on the Shasta-Trinity National Forest. The proposed action is the implementation of a POO for exploratory geothermal activities that would include drilling of up to five exploratory geothermal TCH wells and drilling, completion, and testing of deep (production size) exploration wells at five well pads, as shown in Figure 1.1-2. The proposed action would be located on Federal Geothermal Leases CA-12367, CA-12370, CA-12371, CA-12372, CA-1224, and CA-2500.

OBJECTIVES

The primary objective of the POO is to complete sufficient geothermal exploratory drilling to define and delineate a reserve of commercially viable high temperature geothermal resources that would allow for production to support a commercial geothermal power plant. The activities proposed in the POO are intended to locate and test a geothermal reservoir capable of supporting a minimum 100 megawatt (MW) power plant. At this time, exploratory drilling is necessary to determine if such a geothermal resource exists within the Glass Mountain KGRA. The proposed drilling activities identified in the POO

are the minimum necessary to allow for an adequate delineation of the geothermal resource.

The proposed action would also be intended to advance the exploration program at the Glass Mountain KGRA to the resource evaluation phase, based on a thorough geological evaluation of subsurface geological data and geothermal potential. By implementing the POO, CEGC intends to bring the exploration program to the next logical business decision point, that of testing productivity and commercial development.

Based on existing well data, surface geology, and geophysical surveys, CEGC believes substantial geothermal resources may exist in the KGRA. The exploration and well testing program identified in the proposed POO is designed to gather the temperature, stratigraphic, and reservoir data necessary to determine whether development of the resource is warranted.

DESCRIPTION OF THE PROPOSED ACTION

Summary

The proposed POO would allow the drilling of up to five exploratory geothermal TCH wells and the drilling, completion, and testing of deep exploration wells at five well pads. The TCH wells would be drilled to a maximum depth of 5,500 feet in order to measure temperature and define lithology. The exploration wells would be drilled to depths of approximately 9,000 feet. These wells have been sited based on regional structural geology and the results of temperature analyses at existing TCH wells.

The proposed well sites have been selected to minimize the amount of new surface disturbance. With the exception of well pad 46-32, all wells would be at least partially located on old log landings, logging roads, or in previously clear-cut areas. Well drilling operations would require construction of five well pads measuring approximately 60 feet by 100 feet for the core holes and five well pads measuring approximately 400 feet by 600 feet for the deep exploration wells. Construction of approximately 2,600 feet of new access roads and improvement to about 8,150 feet of existing access roads would be required to provide vehicle access to the drill sites. Total surface disturbance from establishment of the well pads and new access roads would be approximately 29.6 acres. Improvements to existing access roads would range from minor road widening and realignment to clearing re-emergent vegetation within the road.

Operating Procedures

All proposed drilling operations under the POO (including siting of wells, proposed drilling depth, casing and cementing, safety procedures, well plugging and abandonment, and environmental protection) are governed by and would comply with the Federal Geothermal Resources Operational Orders (GROs) Nos. 1-5 administered by the U.S. Bureau of Land Management (BLM).

In addition to the GROs, all drilling operations would be conducted in compliance with specific stipulations of the USFS and BLM permits and leases under the operating

procedures and identified in this EA/IS, access procedures and conditions issued by the USFS, Modoc National Forest, and the BLM's October 1, 1985 Notice to Lessees (NTL) CA-86-01. The NTL CA-86-01 contains requirements for drilling deep temperature gradient holes in the State of California and provides the general parameters for deep temperature core hole drilling that would be conducted as part of the POO.

CEGC has also prepared a Detailed Drilling and Testing Program (CEGC 1994) that contains procedures for operations on BLM leases, as well as an Emergency Contingency Plan and General Safety Practices for drilling operations. Both of these plans would be followed during drilling operations under the POO. These plans are available for review at the BLM Alturas Resource Area Office and the USFS Modoc National Forest Supervisor's office in Alturas, California.

Hard hats would be worn by all personnel during construction and drilling at the well sites. OSHA regulations would be followed by all personnel. Drinking water and sanitary facilities would be provided for personnel by CEGC. Persons not directly involved in the proposed operation would be restricted from the well pads (hard hat area).

Proposed Drill Site Locations

The locations of proposed TCH and exploration well pads were defined based upon results of previous geological and drilling investigations in the area. The five TCH well pads are the minimum necessary to adequately investigate the geothermal resource. These wells have been sited to further delineate the characteristics of the regional geothermal heat flow in the area and to assist in prioritizing the order of drilling for the deep test wells. The TCH well pads have all been sited on previously disturbed areas on old log landings or skid roads.

The five exploration well pads have been placed at the sites anticipated to be near the most promising temperature gradient and structural features that may result in favorable geologic conditions, based on the results of previously-approved temperature gradient well testing. All exploration well pads except for pad 46-32 have been at least partially sited on old log landings, logging roads, or in previously clear-cut areas.

Well Pad Access and Road Construction

Table 2.1-1 identifies the proposed road access to the TCH and exploration well pad sites. The majority of the pads are on existing USFS or logging roads. Two of the 10 pads would require the construction of new access roads. Pad 46-32 would require construction of 2,200 feet of new road. 42-13TCH would require 400 feet of new road, and 1,100 feet of improvements on existing logging roads. Roads would require varying levels of construction activities to establish or improve the roads for vehicle access. Typical improvements would include grading, road widening, vegetation clearance, and widening of turns. CEGC has proposed to install gates on certain access roads or pad entrances to control vehicle access to well pads. Proposed access road gates are shown on Figure 1.1-2. All gates would have dual locks to allow access to BLM and USFS personnel.

Table 2.1-1: Well Site Access and Required Road Construction

Temperature Core Holes	Access and Required Road Construction
34-8TCH	150-foot long old logging road connects an existing gravel road to the site; logging road needs to be recut
42-13TCH	Requires construction of a 1,500-foot access road from an existing dirt road to the site; access road would generally follow the route of an old logging skid road
11-24TCH	400-foot long old logging road connects the pad to an existing paved road (Powder Hill Road); logging road needs to be recut
15-15TCH	Unimproved spur road connects the pad to an existing road (Medicine Lake-Mount Hoffman Road); no road construction required
63-20TCH	Unimproved spur road connects the pad to an existing road to the site; no road construction required
Production Test Wells	
18-32	Unimproved spur road to the existing well 28-32 connects an existing road (Arnica Sink Road) to the site (well pad 18-32 would be partially constructed on the spur road); 5,000-foot long portion of the single-lane spur road near the site would require improvements for drainage, turning radius, and turn-outs
46-32	Requires construction of a new 2,200-foot access road with turnouts from the end of the existing unimproved spur road at pad 18-32 to the site
58-6	1,000-foot long old logging skid road connects an existing unimproved spur road to the site; requires construction of an access road that would follow the route of the skid trail
56-18	500-foot long old logging skid road connects an existing paved road (Tionesta Road) to the site; requires construction of an access road that would follow the route of the skid trail
13-18	Located along an existing unimproved spur road; no road construction required

SOURCE: CEGC 1994

Improved and new access roads to the TCH and exploration well pads would be designed and constructed in accordance with USFS specifications and with good engineering practices. Access roads would be constructed as Class D 14-foot wide single-lane resource roads; in some areas, a maximum 22-foot width would be necessary for turnouts and portions of the roads on slopes that require cut and fill. Roads would be similar in design to those that are used for logging and other timber harvest activities throughout the Modoc National Forest.

The access roads to well pads 46-32, 58-6, and 42-13TCH would be constructed by building graded dirt spur roads similar to the existing spur road to the existing well pad 28-32 (see

Figure 1.1-2). These access roads would be functionally classified by the USFS as single-lane resource roads with the following general design specifications:

- Design speed of 15 to 20 miles per hour (mph)
- Maximum grade of 8 to 16 percent
- Travel way width of 14 feet
- Maximum 22-foot total cleared width in certain locations for turnouts and cut and fill

Gravel and other road materials necessary for improvement and construction of roads are present at the road sites, and no additional material would be required for road work. To minimize dust generation during access road grading and construction, water would be applied to road construction areas as necessary. The water would be trucked from existing water wells in the Arnica Sink area (see Figure 1.1-2 for water well locations).

Specific details of proposed road construction are included in the CEGC Geothermal Sundry Notice that will be submitted to the BLM. Prior to actual drilling at the TCH and exploration well pads, CEGC would obtain a road use permit from the USFS for vehicle travel on area roads.

Drilling activities at each TCH well would be expected to generate a maximum of six to eight round trips per day, which includes two to four water truck deliveries. Monitoring at each TCH well would generate about three or four round trips per day. At the exploration wells, each well site would generate approximately 20 round trips per day during drilling and about four round trips per day during testing.

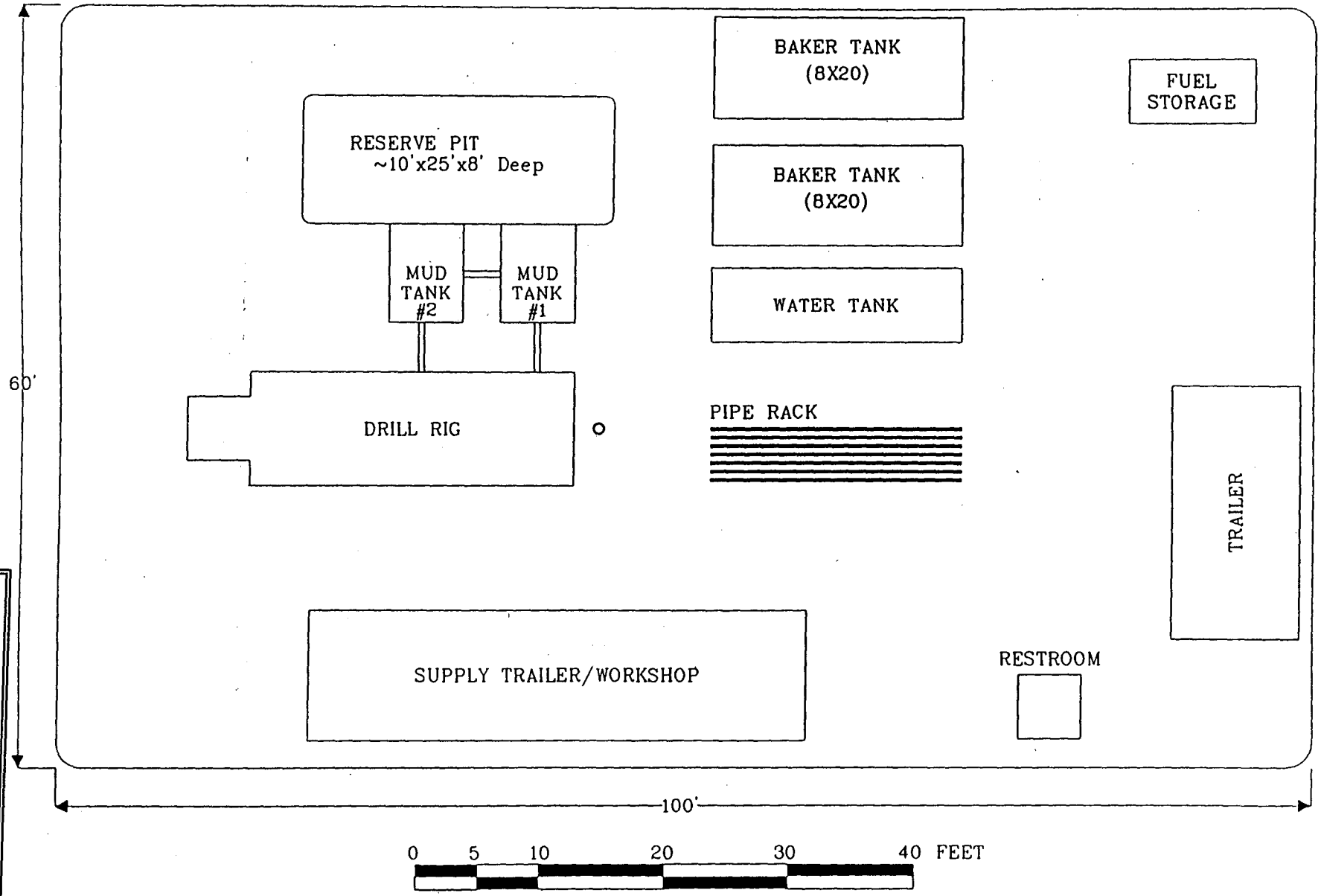
TCH Wells

Figure 2.1-1 illustrates a typical drilling rig and facility layout for TCH wells. Each TCH well site would occupy an area measuring approximately 60 feet by 100 feet. Since the proposed TCH well sites have been previously disturbed and are relatively level, significant cut and fill operations to develop the TCH facilities at these sites would not be necessary. The pads would need to be cleared of any remaining vegetation prior to drilling activities.

Facilities and Equipment: As shown in Figure 2.1-1, typical equipment at each TCH well site would include the truck-mounted drilling rig, casing storage area, a water storage tank, two emergency water tanks (known as "Baker" tanks), a fuel storage tank, a small office/supply trailer, and personnel vehicles. The drilling cores would be stacked at the site and periodically removed to storage off-site. The pad would also include an excavated reserve pit approximately 10 feet wide by 25 feet long by 8 feet deep. Upon completion of the TCH, all support facilities would be removed, the reserve pit would be filled in, and the site would be regraded.

Noise mufflers would be used on all rig engines and air compressor engines. All equipment would be properly maintained and muffled to ensure compliance with the

Figure 2.1-1: Typical Rig and Facility Layout for TCH Well Sites



SOURCE: CEGC 1994

Federal Occupational Safety and Health Act of 1970 and GRO No. 4. All potential spark-emitting equipment would be fitted with spark arresters to meet fire standards.

Electrical power for drilling and testing operations would be provided by portable diesel generating equipment. Mobile telephone and radio communications would be maintained between operating personnel in the field, CEGC's offices in Portland, Oregon and CEGC's technical center in Ridgecrest, California.

Portable sanitary facilities for personnel would be provided and maintained in accordance with state and Federal health standards. Non-hazardous solid waste such as paper, cans, packing materials, etc. would be collected on-site in an approved receptacle and disposed of at a public disposal facility or other approved disposal location.

Drilling and Coring Procedures: Under the drilling program proposed in the POO, an 8-inch hole would be rotary drilled at the TCH well sites with mud, aerated mud, or air-foam (depending on subsurface conditions encountered) to at least 10 percent of total depth and cementing 4.5-inch casing to the surface. Below the surface casing, the hole would be completed using standard diamond drilling core equipment. This coring process provides detailed geologic information while requiring relatively low volumes of drilling fluid. This coring process also allows hole completion without total fluid circulation, which is critical in volcanic terrains.

Drilling procedures at each TCH well site would be as follows:

1. Construct access roads, TCH pad, and reserve pit
2. Move in and rig up a rotary core rig
3. Spud 8-inch nominal hole and drill to approximately 550 feet using a mud, aerated mud, or air-foam drilling fluid
4. Cement 4.5-inch casing to approximately 550 feet
5. Depending on the site-specific conditions at the TCH well, either build a 5-foot by 5-foot by 7-foot cellar or place the rig on a stand to complete rigging up core rig
6. Weld on casing head flange. Nipple up 4.5-inch blow-out preventers (BOP), and install a blind ram and hydraulic operated annular B.O.P. and kill and choke lines. Pressure test all equipment to 500 pounds per square inch (psi), with advance notification to BLM to witness test
7. Install hydrogen sulfide (H_2S) indicator and alarm system
8. Drill out cement plug to below 4.5-inch casing shoe
9. Start core drilling with 2.5-inch ID by 3.78-inch OD wireline coring system, circulating with bentonite mud. Reduce core size as mandated by drilling conditions. As needed, run maximum recording thermometer to bottom of hole at 100-foot intervals to evaluate temperature
10. At completion, run 1.5-inch tubing to total depth; fill with water and cap. Clean up drill pad, fill in or fence reserve pit as appropriate
11. Run periodic temperature surveys up to one year after completion

12. After completion of temperature surveys, plug and abandon the hole in conformance with GROs and stipulations of the BLM.

Well Completion and Abandonment: Upon completion of the TCH, the wellhead gate valve would be chained and locked, or a locking bonnet will be placed over the wellhead cellars to prevent unauthorized corehole entry. Wellhead cellars would be covered with heavy duty timber material and nailed shut. Periodic inspections of the site would be conducted except during periods of winter snows. After completion of all testing, and prior to actual abandonment operations, a proposal for abandonment of the TCH wells, in compliance with GRO No. 3, would be submitted to the BLM and USFS for review and concurrence (see the discussion of reclamation on page 2-17 of this EA/IS).

Exploration Wells

Figure 2.1-2 illustrates a typical drill pad layout (with two wells) for exploration well sites. Well pads are designed to accommodate additional wells for exploration that could be drilled if the currently proposed wells do not provide enough information to determine commercial viability of the geothermal resource. The well pads could be used for development of the geothermal resource if the resource proved to be commercially viable.

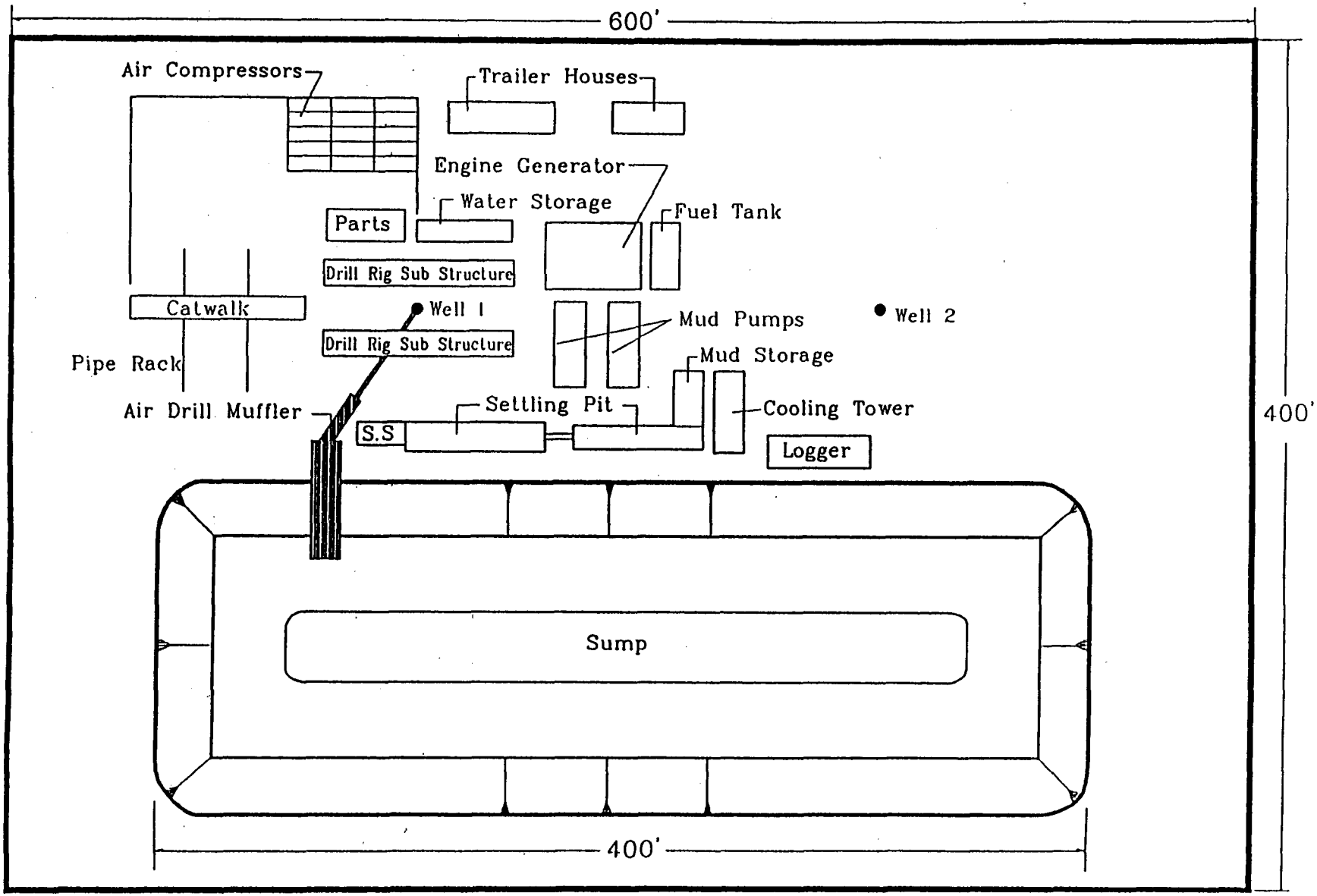
Each test well site would occupy an area measuring approximately 400 feet by 600 feet. This area would need to be cleared of vegetation for drilling activities. With the exception of well pad 46-32, at least a portion of each of the proposed test well sites has been previously disturbed, generally through logging or other geothermal exploration activities. Individual Sundry Notices would be filed with BLM (with a copy to USFS) prior to construction of each exploration well pad.

All test well sites would require varying degrees of cut and fill operations to establish the drilling facilities, minimize erosion, and provide slope stability at these sites. Well pad sites would be graded and compacted to prevent accelerated erosion or gullying in the vicinity of the well pads. In addition, berms, culverts, and other water-control methods would be used. Upon abandonment, well pads would be regraded to original contours and allowed to revegetate.

Facilities and Equipment: Each well pad is designed to accommodate the drilling of a minimum of two exploration wells. Industry standard geothermal rotary drilling rigs equipped with H_2S monitoring devices and blow-out preventers (BOP) would be used to drill the wells. As shown in Figure 2.1-2, typical equipment at each test well pad would include the drilling rig, pipe racks, generators, air compressors, office and supply trailers, and a fuel storage tank. Personnel vehicles and subcontractor and supplier trucks and vehicles would occasionally be present at the well pads.

Noise controls, fire protection, electrical power and communications, and sanitary facilities and non-hazardous solid waste disposal for the exploration wells would be conducted as described for the TCH wells. In addition, the air, rock, and steam returns during air drilling would be directed by a pipe (known as the "blooie line") from the well to a separator/muffler to reduce noise from drilling operations to a minimum. Exhaust

Figure 2.1-2: Typical Drill Pad Layout for Exploration Well Sites



SOURCE: CEGC 1994

stacks on all diesel or gas-driven equipment and vehicles would be equipped with mufflers to minimize air emissions. For air drilling, injected water and a cyclone separator/muffler would be used to control particulates.

Sumps: In addition to drilling facilities, a sump with a capacity of 750,000 to 1,000,000 gallons would be constructed at each test well pad (see Figure 2.1-2). The sumps would be compacted during construction and lined with either clay or an approved plastic liner, either of which would prevent percolation and provide an impermeable layer in the sumps. The lining of the sump would have an estimated maximum permeability of 1×10^{-6} centimeters per second (cm/sec.). The test well pads would be bermed to allow for drainage into the sump.

During the drilling and testing operations, drilling muds and produced fluids would be collected in sumps, reserve pits, or other containers. It is expected that the sumps (750,000 to 1,000,000 gallons) would be adequately sized to hold the volumes of fluids produced during the initial short-term rig flow test, and the longer reservoir flow testing. If the well pad sump is not adequately sized to handle all fluids produced during short-term or long-term testing, the following options for handling excess fluids would be considered:

- Piping or trucking of fluids to nearby sumps
- Piping of fluids to an injection well should one be available
- Stop testing

Concurrence of the BLM and USFS would be obtained before initiating the first or second of these options. If trucks are used to transport excess fluids, these trucks would not use paved recreational travel routes, and appropriate maintenance would be provided by CEGC for haul roads that would be used.

Sump contents would not be considered hazardous. Upon completion of drilling and testing operations, sump contents would be tested. Once testing confirms the contents to be non-hazardous, the contents would be allowed to desiccate, and the sump would be filled in and revegetated or allowed to revegetate if the sump is not needed for further drilling operations. In the unlikely event that testing determines the sump contents to be hazardous, the sump contents would be removed to an appropriate disposal site. If a plastic liner is used for the sump, the liner would be removed to an appropriate disposal site upon completion of drilling and testing operations. The exact method of sump reclamation would be dependent on stipulations of the BLM and USFS and the actual chemical constituents contained in the sump.

Well Drilling Procedures: The following is a summary of the Detailed Drilling and Testing Program for deep wells that has been prepared by CEGC. For more detailed information on aspects of the proposed drilling program such as the Proposed Mud Program, Cementing Guide, BOP Testing Procedure, Testing, Logging, Plug and Abandonment and Disposal, please refer to the Detailed Drilling and Testing Program (available for review at the BLM Alturas Resource Area office and the USFS Modoc National Forest Supervisor's office in Alturas, California).

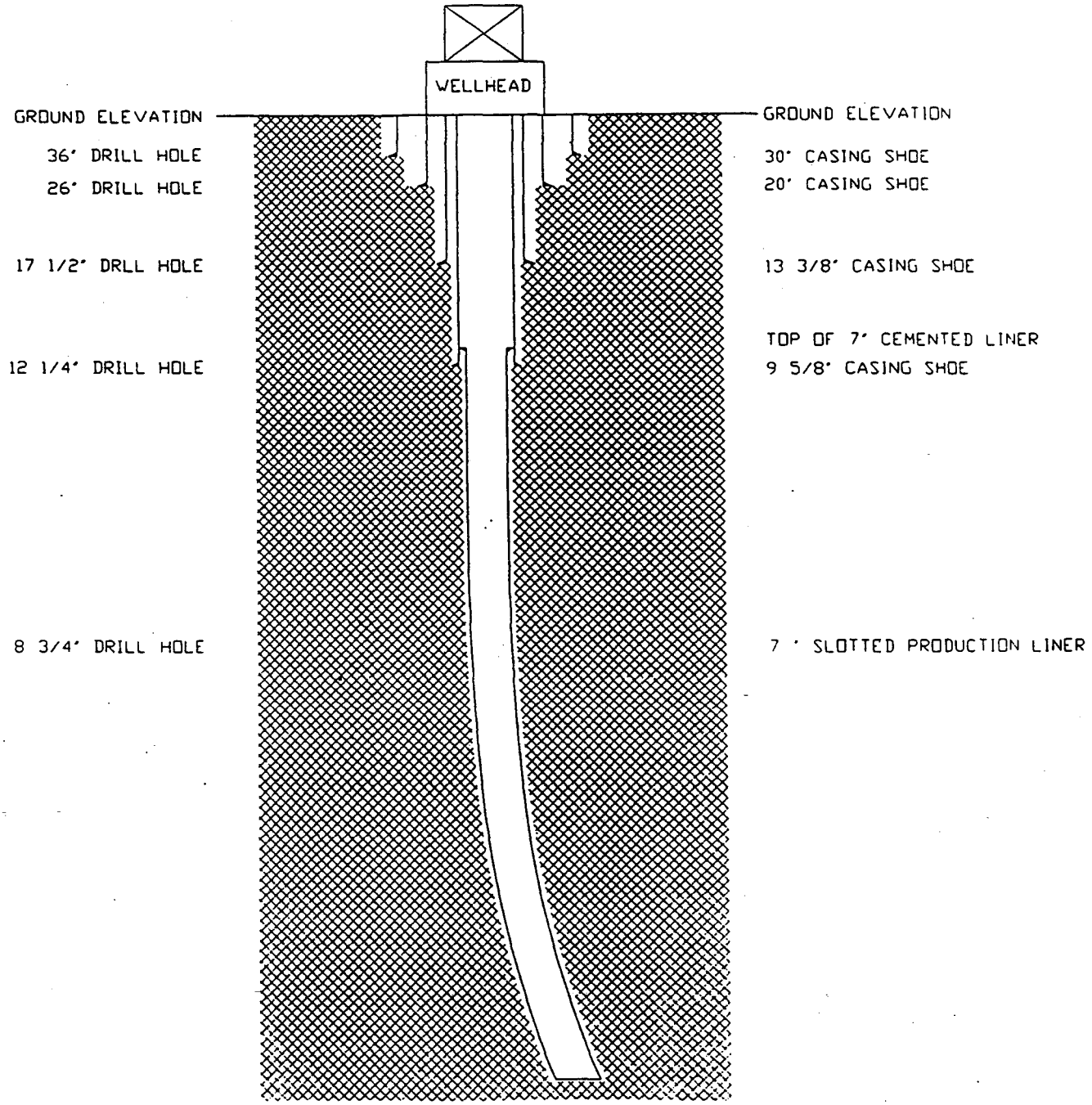
All exploration wells would be completed with directional offsets of the bottom hole locations. Figure 2.1-3 illustrates a typical directional well completion. Each of the two wells on the well pad would be completed with different bottom hole locations. The approximate target of each offset well would be identified in the drilling permit for the proposed action. Basic drilling procedures at each test well pad would be as follows:

1. Drill and set approximately 50 feet of 30-inch OD casing with a dry hole digger and cement same back to surface with Ready-mix cement
2. Drill 17.5-inch and open to 26-inch hole to 350 feet with lightweight bentonite base mud. Run and cement 20-inch surface casing to surface
3. Drill 17.5-inch hole to 2400 feet with lightweight bentonite base mud. Run and cement 13.375-inch intermediate casing to surface
4. Drill 12.25-inch hole to approximately the permitted depth with mud. Run 9.625-inch production casing and cement same to surface
5. If drilling conditions require an additional hole reduction, drill 8.75-inch hole with mud and/or air to approximately 9,000 feet. It is anticipated that the wells would be directional with 1,500 feet offset bottom hole, completed open-hole in the production zone. However, a slotted 7-inch liner may be run to near total depth if required
6. Conduct an initial rig testing, data analysis, and work over until well(s) demonstrate satisfactory commercial potential and then move rig to next location
7. Construct temporary production test facilities, place well on sustained production test for 15 to 45 days. It is probable that two or more wells could be tested at one time
8. If a well does not demonstrate satisfactory commercial potential, work over well as necessary by converting the well to an injection well if appropriate, completing the well as an observation well, or plugging and abandoning the well.

Should downhole conditions warrant, casing programs would be modified (with prior approval of the BLM) to ensure adequate safety margins and optimum production potential. If shallow water sources are encountered during drilling, the casing programs would be designed to ensure that the well is sealed from these formations. Drilling would use appropriate blow-out prevention equipment as specified in GRO No. 2 and would be initiated using non-toxic drilling mud, as defined by the U.S. Environmental Protection Agency (EPA) and California EPA (Cal EPA). When indicated by downhole conditions, compressed air would be used.

During mud drilling, the mud and rock cuttings would be separated at a "shale shaker" and desander, and the mud would be recirculated. An additional "de-watering" process may also be used to further separate sand, mud and fine particles. The processed solids would be discharged to an entirely separate "storage pit" or containers on the well pad. The reclaimed water would be recycled without entering the sump. Drilling mud waste and fluids would be restricted to the mud sump. During the mud drilling stage of operations, drill cuttings from the well bore would be run over a vibrating shaker screen and dropped into a settling tank with a sand auger. After washing with water, cuttings would be augured to a three-sided metal container.

Figure 2.1-3: Typical Directional Well Completion



SOURCE: CEGC 1994

GMU EA/IS

Periodic samples would be taken of the drilling materials and evaluated to ensure that the cuttings and mud waste are non-hazardous. During this evaluation, cuttings would be taken from the metal container by a front-end loader and stored on the well pad site. Once the separated cuttings are determined to be non-hazardous, the cuttings would be disposed of by spreading the material (which is similar to pea gravel) on the well pad and access roads. In the unlikely event that the cuttings are determined to be hazardous, the material would be dealt with as a hazardous material and disposed of at an appropriate waste disposal site.

Well Testing Procedures: The well testing procedure would initially consist of a short-term flow test from each exploration well through surface control equipment until the well flows have cleared and attained stable reservoir flow conditions. During this short-term (1 to 3 days) testing, all fluids would be diverted to the sump, while steam and non-condensable gases would be vented to the atmosphere. Steam and produced fluid samples would be collected for analyses of chemical constituents and noncondensable gases. Should the capacity of a sump be reached during short-term testing, various options would be considered for handling excess fluids (see the discussion of sumps).

If an exploration well proves to be of satisfactory commercial potential, temporary well testing facilities would be established at the well pad site for long-term (up to 90 days) production testing. All testing facilities would be constructed on previously cleared areas within the well pad. All geothermal fluids produced during long-term flow testing would be directed to the sumps before being piped to a nearby well for injection back into the geothermal reservoir. Temporary above-ground pipelines would be laid from the well test to the injection well along existing roads or other approved routes; no new surface disturbance would be required for these temporary pipelines.

After the exploration wells have flowed for a sufficient time at stable conditions to enable CEGC staff to gather necessary production and reservoir data, the well would be shut-in, and downhole pressure buildup data at the reservoir depth would be obtained to record post-production transient phenomena. The entire test would be conducted within 30 days under ideal conditions. However, depending upon production characteristics, extended test periods of over 90 days could be required. If testing stops because sump capacity has been reached (i.e., there are no injection wells available) sump contents would be pumped back into the production well after shut-in conditions have been recorded.

If an exploration well does not exhibit economic production capability, the well would be considered for use as an injection/disposal/reservoir maintenance well. Should remedial work on the well be required to convert the well to an injection well, agency concurrence would be sought by application to the BLM for Permit to Drill or Sundry Notice. A Sundry Notice would be submitted to convert a well to injection status, and sufficient geological and well casing information would be supplied to assure that produced fluids are being returned to the production zone.

Well Abandonment: If an exploration well does not exhibit economic production capability and is not suitable for conversion to an injection well, the well would be

abandoned. Well abandonment would be accomplished in accordance with the GROs, stipulations of the BLM and USFS, and all other applicable permits or regulations (see the discussion of reclamation of page 2-17 of this EA/IS).

Water Supply

Water for construction activities and drilling and coring activities at the TCH and exploration well pad sites would either be trucked in or piped to the well pad sites from existing water wells in the Arnica Sink area (see Figure 1.1-2 for water well locations). If piping is practical, temporary above-ground pipelines would be laid from the water wells to the well pad sites along roads or other appropriate routes approved by the BLM and USFS. No new surface disturbance would be required for these temporary pipelines. For drilling at well 63-20TCH and 15-15TCH, CEGC could obtain water from existing wells such as Pumice Stone or Harris Springs (located approximately five to six miles west of Little Mount Hoffman) if required due to the distance of these proposed TCH wells from the Arnica Sink water wells and to avoid the use of water transport trucks on paved recreational travel routes near Medicine Lake.

The proposed TCH well operations would require approximately 3,000 to 5,000 gallons of water per day. Exploration wells would require approximately 9,000 gallons of water per day, and up to 40,000 gallons may be used in lost circulation zones. Under lost circulation conditions, a minimum of 20,000 gallons per day might be used. Produced fluids from successful wells may be used to reduce the need for other drilling water sources.

CEGC and subcontractors would provide bottled drinking water for all personnel at the well pad sites.

Fire Prevention

Fire extinguishers, water, and hand tools would be kept on site at all times, and employees would be instructed in their use. Spark arresters would be used on all potential spark-emitting equipment. Smoking would be allowed only on the cleared well pad. USFS fire prevention rules would be distributed to and reviewed with drill site employees and service personnel.

Personnel

Well site drilling crews, supervisory personnel, and other geothermal personnel would be expected to commute on a daily basis to the well sites from either existing housing (for local labor) or existing and available accommodations in the vicinity of the proposed action such as motels and trailer parks (for non-local labor).

CEGC plans to utilize local contractors for road and well pad construction, road maintenance, and for general labor such as setting up well test equipment and any necessary water lines. Drilling contractors would be expected to utilize their owned trained drilling crews as much as possible, but from 10 to 50 percent of the crews could be

from the local labor force. All supervisory and technical personnel would be non-local CEGC employees that would be brought in specifically for the POO.

TCH Wells: At the TCH wells, a total of approximately three to six personnel would be at a well site 24 hours per day at any given time during the drilling and well logging operations. TCH coring rig crews would generally consist of from two to three men per eight-hour shift, with 3 eight-hour shifts per day. Coring rig personnel would only be at a particular well site during the 25- to 60-day drilling operations. Other personnel that would be at a TCH well site during both the drilling and well logging operations would include CEGC supervisory personnel, water truck operators, and maintenance and supply personnel.

Exploration Wells: At the exploration wells, a total of about nine to 14 personnel would be at a well site 24 hours per day at any given time during the 60- to 90-day drilling operations. It is expected that on-site personnel during drilling operations would include one CEGC drilling supervisor, one contractor rig supervisor, five rough necks, one mud logger, and one mud engineer (working 12-hour shifts, with two 12-hour shifts per day). There would also be one to two supply personnel on site at any given time performing specialty operations such as mud mixing, refueling, cementing, or delivering supplies. In addition, an on-call geologist would be available, and one to two CEGC employees would be working in the area on geology and project coordination; these personnel could be at a particular well pad at any given time.

During the 30- to 90-day testing of the exploration wells, technical support staff would be at a well site 24 hour per day, seven days per week. A total of one to six personnel could be at a well site at any given time. From one two maintenance personnel would be at a well site at all times during testing. In addition, one reservoir engineer, one on-call geologist, and one to two supply personnel could be at a particular site at any given time.

Schedule

All proposed exploration activities would occur during the late spring, summer, and early fall in any given year. Due to the high elevation of the proposed project area and the large amount of snowfall that occurs in the project vicinity during the winter months, access to the well pads for drilling activities would not occur during this period.

TCH Wells: The five exploratory geothermal TCH wells are scheduled to be drilled during 1995, 1996, and 1997, and should all be completed before 1999. The drilling of the TCH wells would proceed sequentially, with one TCH well being drilled at a time. It is expected that the first TCH well would be drilled during the early fall of 1995, the next two TCH wells would be drilled during the late spring to early fall of 1996, and the final two TCH wells would be drilled during the late spring to early fall of 1997.

Although the exact order of drilling has not been finalized, it is anticipated that 42-13TCH would be drilled first, followed by 11-24TCH and 34-8TCH. If these first three TCH wells adequately delineate a commercially viable geothermal resource, it may not be necessary

to drill the remaining TCH wells (15-15TCH and 63-20TCH). However, given the need to adequately delineate the geothermal resource, it is anticipated that drilling of all of the TCH wells would be necessary. Wells 15-15TCH and 63-20TCH would therefore be drilled in sequence after the first three wells are drilled.

Each TCH well would take from 25 to 60 days to drill, depending on depth and drilling conditions. After drilling is completed, the TCH wells would be maintained as temperature observation wells for as long as necessary to monitor the geothermal gradient. Operations at TCH well sites could be disrupted by fire closure orders. Upon completion of the monitoring phase, the TCH wells would be plugged and abandoned in accordance with the GROs, stipulations of the BLM and USFS, and all other applicable permits or regulations.

Exploration Wells: The development of the five exploration well pads under the POO would have a relatively flexible schedule and would take from three to four years to complete. Drilling at the first of exploration well pads would be initiated during the summer of 1995. Although CEGC currently plans to drill these wells sequentially (only one well at a time), the POO proposes the flexibility of drilling up to two wells at the same time. The first three wells could be drilled during the late spring to early fall of 1995, and the remaining two wells could be drilled in either the summer of 1996 or 1997.

In order to fully test the productivity of the proposed exploration well sites, CEGC currently plans to drill the exploration wells in the following sequence:

1) 18-32
2) 46-32
3) 58-6
4) 13-18
5) 56-18

However, CEGC requires a certain amount of flexibility in their drilling sequence in order to appropriately test the drill locations for their long-term commercial development suitability. The results of drilling at a particular well pad would affect the decision of which well pad to drill next. For example, upon completion of testing at 18-32, the results of this testing would be used in deciding whether to drill 46-32 or 58-6 next. Drilling and testing of two different wells could also occur at the same time.

Each exploration well would take from 60 to 90 days to drill and complete. After drilling is completed, testing activities at the well would begin. Each well would be tested for 30 to 90 days, depending on the production characteristics of the particular well. Operations at exploration well pads could be disrupted by fire closure orders. Upon completion of the testing phase, a decision on the final use or abandonment of a well could take several years until all testing of the geothermal resource is completed. If a well is unproductive and the reservoir is determined to be non-commercial, the well would be plugged and abandoned in accordance with the GROs, stipulations of the BLM and USFS, and all other applicable permits or regulations.

Reclamation

CEGC would be responsible for posting reclamation bonds with the BLM and USFS to ensure that all project activities would be reclaimed in a timely manner following completion of the proposed action. The bonds would be established prior to any construction activities, and would be a condition of approval for the proposed action. The bonds may be posted for either the entire Unit Area or for individual well pad sites.

Following completion of all testing at TCH wells, a proposal for abandonment of the TCH wells would be submitted to the BLM and USFS for review and concurrence. Abandoned TCH well pads and associated access roads would be restored to pre-project conditions to the greatest extent possible. TCH well pads and access roads would be recontoured approximately to their pre-project contours. Any topsoils stockpiled during construction would be replaced and the site would be reseeded and planted with native vegetation, as necessary, to minimize the potential for erosion. Revegetation of the TCH well pads would be expected to occur relatively rapidly since the TCH pads would receive minimal surface disturbance and soil compaction. More effort would be required to restore TCH access roads to natural conditions. These facilities would be recontoured, scarified to loosen the top soil, and reseeded and planted with native vegetation, as necessary.

If the geothermal reservoir is determined to have commercial potential, two options would be available for the exploration wells. If a well is unproductive, the well would be either plugged and abandoned, or considered for use as an injection well or redrilled with a second directional leg for more testing. If a well is determined to be productive, the well would be considered for development as a production well. These decisions would be made as part of the Plans of Utilization and Development that would be required for commercial development of the geothermal reservoir, and are not a part of the POO.

Although the fate of the exploration well pads at the end of the life span of the proposed action is unknown at this time, reclamation of exploration well pads and access roads would include the same elements described for restoration of TCH wells and access roads. Sumps would be filled in and the pad would be scarified prior to recontouring.

2.2 Alternative B—Elimination of Well Pads Near Medicine Lake

Alternative B would involve drilling activities at all of the well pad sites identified in the POO except TCH wells 42-13TCH and 15-15TCH, which are near Medicine Lake (see Figure 1.1-2). These core hole wells would not be drilled under this alternative due to public concern over the proximity of the well pads to Medicine Lake. In addition, the old logging skid road to well 42-13TCH would not be improved. Public concerns for TCH wells 42-13TCH and 15-15TCH include the following:

- Potential for conflict with residences at Medicine Lake through geothermal emissions, noise, and traffic
- Effects on property values of residences at Medicine Lake
- Potential for conflict with tourism and recreation at Medicine Lake

- Effects to the Medicine Lake water table and lake level
- Potential to interfere with water supply to Medicine Lake

All drilling and testing activities and procedures at the other three TCH wells and the five exploration well pads would be the same under this alternative as described for the proposed action.

Elimination of wells 42-13TCH and 15-15TCH would limit the amount of geological knowledge that can be obtained by the project proponent about the geothermal resource. The knowledge that can be obtained from these TCH wells is considered to be critically important by CEGC in determining the future commercialization potential of the geothermal resource, and CEGC considers that the number of TCH wells identified in the POO is the minimum necessary to adequately investigate the geothermal resource. The TCH wells at well pad sites 42-13TCH and 15-15TCH would provide:

- Deep subsurface information about the regional geology, heat flow rate, rock types, alteration mineral assemblages, faults, and fracture that occur beyond the boundaries of the known resource production area
- Data regarding the Medicine Lake basin water table and regional hydrology
- Information on geologic and hydrologic systems in the Medicine Lake vicinity that could be used to understand and protect shallow aquifers and the potable water supply in the area

CEGC considers the collection of information at 42-13TCH and 15-15TCH to be necessary in developing an adequate three-dimensional model of the geothermal reservoir. CEGC has sited well pad sites 42-13TCH and 15-15TCH on previously disturbed areas in order to minimize the amount of new surface disturbance and associated environmental impacts while still accomplishing the goals of the proposed POO.

2.3 Alternative C—Elimination of Well Pads Near Mount Hoffman

Alternative C would involve drilling activities at all of the well pad sites identified in the POO with the exception of exploration well pads 18-32 and 46-32, which are located near Mount Hoffman (see Figure 1.1-2). Exploration wells at these pads would not be drilled under this alternative due to their suitability as habitat for several species, including the state and federal endangered northern spotted owl (*Strix occidentalis caurina*). These two well pad locations are within the Mount Hoffman Roadless Release Area (RRA). Under this alternative, well pads 18-32 and 46-32 would not be developed, the new access road to well pad 46-32 would not be constructed, and the existing spur road to well pad 18-32 would not be improved.

All drilling and testing activities and procedures at the other three exploration well pads and the five TCH wells under this alternative would be the same as described for the proposed action.

Elimination of exploration well pads 18-32 and 46-32 would prevent CEGC from investigating the commercial potential of the portion of the geothermal resource that is located near Mount Hoffman. Geothermal exploration at the existing TCH well at well pad site 28-32 (see Figure 1.1-2) has already determined that the area near Mount Hoffman has high heat flow and is a highly prospective geothermal area. The siting of exploration wells at well pad sites 18-32 and 46-32 would further test the geological structures in this area for commercial resource production. The subsurface geological information that would be collected during testing at these wells is considered necessary by CEGC to adequately assess the high heat flow area in the Mount Hoffman region for resource production and to develop an adequate three-dimensional model of the geothermal reservoir. These wells would also provide data regarding geologic and hydrologic systems in the Medicine Lake vicinity.

CEGC has sited well pads 18-32 and 46-32 to obtain the necessary information regarding the geothermal resource in the vicinity of Mount Hoffman while avoiding environmentally sensitive areas to the greatest extent possible. The specific sites for well pads 18-32 and 46-32 were selected by CEGC through consultations with the USFS and wildlife biologists primarily because they contain a minimum of the necessary habitat components for sensitive wildlife species such as the northern spotted owl (which would therefore minimize potential effects from POO implementation on wildlife habitat). There are no previously disturbed pad locations in the immediate Mount Hoffman vicinity that could be drilled (either directionally or conventionally) and used to adequately test the geothermal resource in this area.

CEGC considers that the number of exploration wells identified in the POO is the minimum necessary to adequately test the geothermal resource. If well pads 18-32 and 46-32 are eliminated, CEGC feels that there would not be enough information collected to determine the commercial viability of the geothermal resource within the Glass Mountain KGRA.

2.4 Alternative D—No Action

Under Alternative D (referred to as the "No Action" alternative), the proposed POO would not be implemented. Exploratory drilling and testing of the geothermal resource described in the POO would not occur.

This alternative would prevent CEGC from collecting any additional information about the geothermal resource and from making a decision regarding the commercialization of the resource. This alternative would not be consistent with the geothermal leases that have been issued for the Glass Mountain KGRA, which explicitly provide for the exploration, development, production, and utilization of the leases.

3: DESCRIPTION OF THE AFFECTED ENVIRONMENT

3: DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 Introduction

This section of the EA/IS provides a description, by environmental parameter, of existing conditions in the vicinity of the proposed action. These descriptions of the affected environment are based primarily on site visits and surveys, consultations with USFS personnel, and information contained in the following documents:

- *Geothermal Leasing of National Forest Lands in the Glass Mountain Known Geothermal Resource Area Supplemented Environmental Assessment* (BLM and USFS 1984)
- *Modoc National Forest Land and Resource Management Plan* (USFS 1991a)
- *Modoc National Forest Land and Resource Management Plan Final Environmental Impact Statement* (USFS 1991b)

Other references that have been used specifically for a particular environmental parameter are identified in Chapter 6.

3.2 Geology and Soils

GEOLOGY

Regional Geology

The proposed action is located in the Medicine Lake Highlands, which are composed predominantly of volcanic formations. Landforms within the Highlands are cinder cones, caldera basins, craters, irregular rhyolite lava flows, steep volcanic side slopes, recent obsidian lava flows, and basalt capped plateau. The basement rocks of the Highlands are

the Cedarville Series and Warner Basalts, which formed much of the Modoc Plateau some 15 to 30 million years ago during the Miocene epoch. Subsequent to these flood basalt events, the Medicine Lake Highlands formed as a large, gently sloping shield volcano about 20 miles across and 2,500 feet high. This shield eventually collapsed some 500 feet, to form an elliptical caldera approximately six miles long by four miles wide. Medicine Lake is located in the remnant of the caldera.

After collapse, subsequent eruptions built new "rim" volcanoes around the caldera, resulting in a group of volcanic peaks: Mount Hoffman, Badger Peak, Red Shale Butte, and Lyons Peak. On the flanks of the volcano there are numerous parasitic cones and recent lava flows including: Big Glass Mountain, Little Mount Hoffman, Little Glass Mountain, Pumice Stone Mountain, Burnt Lave Flow, Callahan Flow, and Stud Hill.

The Medicine Lake Highlands have undergone very recent volcanic activity, including the eruption of basalt flows, obsidian flows and domes, and pyroclastic pumice. The more recent basalt flows are thought to be as young as 500 years. Erupted materials that now form the rocks and soils in the vicinity of the proposed action include: andesite, dacite, rhyolite, basalt, cinders, pumice, obsidian, and ash. Much of the caldera rim and floor has also been influenced by glaciation.

Unique Geologic Features

The relatively recent volcanic activity in the Medicine Lake area has produced several unique geologic features of particular interest in the vicinity of the proposed action. The Glass Mountain Glass Flow, Medicine Lake Glass Flow, and Burnt Lava Flow have been classified as Geological Special Interest Areas. The *Modoc National Forest Land and Resource Management Plan* calls for protection of these geologic areas to preserve their undisturbed condition while providing educational, scientific, and recreational opportunities. The lava and glass flow areas in the vicinity have been used as sources of obsidian by Native Americans (see section 3.4, Cultural Resources). The site for well 58-6 is located approximately 125 feet from the Glass Mountain Glass Flow.

GEOLOGIC HAZARDS

The proposed action is not situated in an area of high seismic activity. However, there are numerous active and inactive faults in the region. The Likely Fault and the Surprise Valley Fault, located 50 miles and 75 miles respectively from the project area, have the potential to produce a seismic event of magnitude 5.0 or greater on the Richter scale.

The Medicine Lake area has had at least three eruptive volcanic cycles in the last 1,500 years. As a result, the United States Geologic Survey (USGS) has identified the Medicine Lake Highlands as one of the four most probable sites in California where a volcanic eruption may occur. Lava flows, ash depositions, phreatic explosion, and extentional ground crack development are all potential geologic hazards that may occur in response to a renewal of volcanic activity.

The vicinity of the proposed action is considered to have a low risk of slope movement because of gentle to moderate slopes (less than 30%), stable parent material (volcanic bedrock), and cohesive soils.

GEOTHERMAL RESOURCES

The geothermal resource at the Glass Mountain KGRA has been characterized by extensive temperature gradient drilling and geophysical surveys. In addition, four deep exploration test wells have been drilled in the Glass Mountain Unit Area. Previous exploratory drilling activities are described in Chapter 1, Introduction.

The geothermal reservoir is believed to have a small, shallow magma chamber that heats a relatively deep hydrothermal reservoir system. Table 3.2-1 presents a chemical analysis of the thermal waters produced from existing test wells at the Glass Mountain reservoir. This chemical analysis shows that geothermal fluids from the reservoir are relatively enriched in certain constituents such as chloride, silicon dioxide, sodium, potassium, and lithium.

SOILS

Soils in the vicinity of the proposed action are of volcanic origin. Parent material consists of basalt, andesite tuff, pyroclastic pumice, cinders and ash of various geologic ages. The primary soil types on the Medicine Lake Highlands are the Smarts, DeMasters, Lamondi, Stonewell, and Yallani families. These soil families are deep to moderately deep, with good drainage and low potential for slope stability hazard. These soils exhibit relatively high forest productivity with moderate to low potential for erosion (U.S. Department of Agriculture 1993).

Table 3.2-1: Chemical Analysis of Glass Mountain KGRA Thermal Waters[1]

Constituent	Concentrations (ppm)[2]
Silica (SO_2)	582.3
Sodium (Na)	632.0
Potassium (K)	107.7
Calcium (Ca)	7.9
Magnesium (Mg)	0.1
Bicarbonate (HCO_3)	49.0
Sulfate (SO_4)	46.9
Chloride (Cl)	1,021.2
Lithium (Li)	3.1

Notes:

[1]Thermal water samples were obtained from the existing well at pad 87-13; the pH of the thermal waters was measured at 8.6.

[2]ppm = parts per million; highest reported values shown.

SOURCE: CEGC 1994

3.3 Hydrology

SURFACE WATER

Medicine Lake is the main body of water in the vicinity of the proposed action and the largest body of water within twenty miles. At an elevation of 6,676 feet above sea level, Medicine Lake represents the lowest elevation within the caldera. Other surface water bodies include Little Medicine Lake (elevation 6,680 feet), Bullseye Lake (elevation 6,750 feet), and Blanche Lake (elevation 6,750 feet). There is also a large dry lake, Arnica Sink, located 1.5 miles east of Medicine lake at an elevation of 6,696 feet. In general, the surface hydrology in the vicinity of the proposed action flows away from the Medicine Lake Crater and Medicine Lake.

Medicine Lake water has been found to be of good quality with very good clarity, naturally low nutrient levels, and good buffering capacity. Water quality monitoring has not been conducted at other water bodies in the vicinity of the proposed action, but all other sources are believed to be of excellent quality (Jones 1983).

There are three springs in the area: Paynes Springs, Schonchin Spring, and Crystal Springs. Paynes Springs is the source of Paynes Creek, a perennial creek approximately two miles long (see Figure 1.1-2). Other streams in the project area are intermittent, only flowing after snowmelt and as intense storm runoff.

NEPA requires that an EA address certain Critical Elements of the Human Environment. The project area does not contain the following Critical Elements that are related to surface water: floodplains, wetlands/riparian areas, or Wild and Scenic Rivers.

GROUNDWATER

The Medicine Lake Highlands have several distinct groundwater recharge basins. Most of the recharge occurs during the spring when melting snow infiltrates the volcanic soils. In the caldera area of the Medicine Lake Highlands, the depth to the first major aquifer is generally 200 feet. On the flank of the shield volcano, the depth to the aquifer is very erratic and varies from 300 feet to over 1,000 feet. At the base of the shield volcano, the depth of the water table is approximately 500 feet.

WATER SOURCES

The USFS currently uses two sites in the vicinity of the proposed action for withdrawing water. One site is at Medicine Lake, and the other site is at the Tionesta well located east of the proposed action. At the Medicine Lake site, water is pumped from a well near the lake and used for domestic consumption, fish habitat, recreation, road construction, and fire suppression. The Tionesta well is located at the base of the shield volcano. The water from this well is used for road construction and fire suppression.

There are two existing water wells located in the Arnica Sink area about 1.2 miles northeast of Medicine Lake. These wells were drilled to support previous geothermal

exploration activities. Well #1 was drilled by Philips Petroleum and was dedicated to the USFS which uses it for activities such as logging road maintenance. Well #2 was drilled by Unocal and is currently owned by CEGC.

HYDROLOGIC MONITORING

The U.S. Geological Survey (USGS) is currently proposing to assume hydrologic and geochemical monitoring responsibilities for hydrothermal resources in Northern California and Oregon, including the hydrothermal resource at Glass Mountain. The USGS has prepared a draft *Hydrologic Monitoring Plan for the Glass Mountain Area* (USGS 1994) that identifies the proposed monitoring program for the region. The monitoring plan focuses on monitoring water levels in water wells, measuring discharge of springs in the area, and analyzing and monitoring water quality of well, spring, and lake waters. The plan would also monitor a geothermal "hot spot" from which hot gases discharge from two distinct vents; the hot spot is located about one mile east of the proposed well pad 46-32 (see Figure 1.1-2).

3.4 Cultural Resources

The proposed action would take place in the vicinity of the Glass Mountain lava flow within an area known as the Medicine Lake Highlands (see Figure 1.1-2). A site survey and record search for cultural resources at Medicine Lake Highlands was completed in October 1994 by Far Western Anthropological Research Group, Inc. (Far Western 1994). The results of Far Western's survey and record search are summarized below.

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. 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, and topography has favored access from the east.

PREHISTORIC

Prehistoric site types found on the Modoc National Forest 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 Medicine Lake Highlands contain toolstone-quality obsidian associated with the many obsidian flows in the area. Identified prehistoric sites are generally located near or on these flows. Most of the prehistoric sites recorded in the Medicine Lake Highlands are quarries associated with the obsidian flows. Reflective of the fact that most known prehistoric sites in the Medicine Lake Highlands are quarries, chipping debris and broken

bifaces characterize the prehistoric assemblages. Little evidence of milling equipment or hunting equipment has been discovered.

Surveys of the Medicine Lake Highlands indicate that there is a very low prehistoric site density in this area. The most comprehensive cultural resources survey that has been conducted in the vicinity of the proposed action was a survey of the Medicine Lake Highlands, Lava Beds National Monument, and Lower Klamath/Tule Lake areas (Hardesty and Fox 1974). A total of 768 cultural resource sites were recorded during this survey. Although no base camps were identified, the following five different types of "work camps" were recorded:

- Hunting blinds (two recorded)
- Fortifications (three recorded)
- Semi-permanent camps (26 recorded)
- Chipping stations (114 recorded)
- Quarries (594 recorded)

Two semi-permanent camps, two chipping stations, and all of the quarry sites were located within the Medicine Lake Highlands. These prehistoric activity sites were generally located either on or near the obsidian flows. An Elko corner-notched projectile point was also collected from the Medicine Lake Highlands (Hardesty and Fox 1974).

Other prehistoric resource surveys conducted in the Medicine Lake Highlands have mainly been performed by the USFS (Cassidy 1992; Henn 1990; Sundahl 1985). These surveys have identified primarily chipping debris and broken bifaces associated with prehistoric assemblages.

No prehistoric resources were discovered at any of the proposed well pad sites or within any of the access road corridors during Far Western's October 1994 cultural resources survey (Far Western 1994).

HISTORIC

Modern-day influences on the Medicine Lake Highlands have been minor, largely restricted 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. The lack of modern-day influences contributes to the area's current popularity for outdoor recreation, including camping, hiking, fishing, and hunting.

No historic resources were discovered at any of the proposed well pad sites or within any of the access road corridors during Far Western's October 1994 cultural resources survey (Far Western 1994). Two modern fire-rings (built of rocks with charcoal still evident) were identified, but these were not recorded due to their obvious modernity.

NATIVE AMERICANS

Native American History

The general vicinity of Medicine Lake and the Modoc National Forest 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 Native Americans and the abandoned villages, camps, and other remains left by the native prehistoric peoples.

Paleo-Indians were the earliest inhabitants of the general vicinity of Medicine Lake. These peoples lived in the area approximately 10,000 to 11,000 years ago, at the end of the last Ice Age. Using fluted projectile (spear and dart) points, they hunted big game such as mammoth, bison, ground sloth, and other extinct animals. Native American peoples who lived in the Medicine Lake vicinity about 8,000 years ago left abundant evidence of their habitation. Most prehistoric archaeological sites contain surface materials (chipping debris and projectile points) spanning the last 4,000 to 6,000 years. During this period, various native cultures specialized in their adaptations to locally available resources, such as obsidian, and food and medicinal plants.

The Medicine Lake area has historically been used by a variety of Native American 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 in the vicinity of the Modoc National Forest and the Lava Beds National Monument (to the north of the project area) involving lifeways that have been adaptive of the environment. During periods of occupation, these Native American groups seasonally inhabited settlements throughout the region, and generally returned to the same village sites and camping spots year after year. Food resources were used on a seasonal basis whenever and wherever they occurred.

The tribes that comprise the Klamath Tribes group (the Klamath and Modoc Tribes and the Yahuskin band of the Northern Paiute Tribe) and the Pit River Tribe have been the principal recent Native American occupants of the region. The Klamath Tribes group was formed as a result of the 1864 Treaty, and the Council of the Klamath Tribes is made up of representatives of each of the three tribes in the group. Although the Klamath and Modoc Tribes are related linguistically, these two tribes identify themselves as different groups. The Yahuskin band of the Northern Paiute is not linguistically related to either the Modoc or Klamath Tribe. The Klamath Tribes and the Pit River Tribe historically and currently use the vicinity of the Modoc National Forest primarily for spiritual and traditional cultural heritage activities and gatherings. Traditional uses in the area include collecting and harvesting forest resources for food, medicine, clothing, tools, and art work.

Of the recent Native American occupants of the region, the Klamath Tribes group has been the primary user of the project vicinity and Medicine Lake Highlands, and therefore is very interested in other proposed uses in the area. The Pit River Tribe is the other Native

American group that has expressed interest in activities in the area. Both of these tribes have ceremonial, religious, and other special sites in the Medicine Lake Highlands. Other tribes have also occasionally used the area, primarily to obtain obsidian for tool making.

Consultation and Concerns

The American Indian Religious Freedom Act (AIRFA) requires that local Native American groups be consulted regarding any proposed projects that may affect traditional religious practices. In accordance with AIRFA, consultations with local Native American groups are currently being conducted by the USFS, Modoc National Forest, regarding the proposed action. Native American groups have been notified during preliminary planning activities for the proposed action in advance of general public notification. Advance notification of the groups was undertaken to ensure that Native American groups were provided with ample opportunities to express their concerns, and to ensure that their concerns are addressed. Concerned Native American groups were sent a copy of the IP/PAI notice for the project, which summarized the proposed action. No written comments regarding the proposed project were received from Native Americans groups.

Three meetings with Native American groups (one with the Pit River Tribal Council and two with the Klamath Tribes) and one site visit (with the Klamath Tribes) have been conducted by the USFS and BLM. The meeting with representatives of the Pit River Tribal Council was held on October 14, 1994. A full quorum of Council Members was not present. The majority of the comments on the project were presented by a Council member with experience working at The Geysers geothermal field in Northern California (The Geysers is one of only three dry-steam geothermal fields in the world. The Geysers is the largest geothermal field in the United States with over 1800 MW of generating capacity. This type of geothermal resource is not expected at Glass Mountain.). The following concerns about the proposed action were expressed:

- Opposition to development
- Reclamation of well pads after project completion
- Potential fire hazards
- Effects on wildlife
- Number of sites proposed

The Council Members indicated that they would need to discuss the project and that they would like a presentation from the geothermal companies and requested a field trip to Medicine Lake Highlands to view the area. The USFS therefore attempted to set up a site visit with representatives of the tribe, and a site visit planned for early November 1994. However, tribe representatives were not able to attend the visit due to weather conditions.

On April 29, 1994, the USFS sent a request to the Tribal Chairman of the Klamath Tribes group for a meeting to discuss potential geothermal activities at Glass Mountain. A second request was made on June 17, 1994 when no response had been received regarding the first request. As a result of the second request, a meeting with the Klamath Tribes was held on October 18, 1994. A site visit with the tribe to review proposed and existing well

pad sites in the area was then conducted on November 3, 1994, and a second meeting with the tribe was held on February 2, 1995.

During the October 18 meeting with representatives of the Klamath Tribes group, several questions were asked about the proposed project, including:

- Cultural resource studies that have been done
- Objective of the project
- Difference between temperature gradient and exploratory production wells
- Acreage required for a power plant (although not currently proposed)
- Size of pipes
- Reclamation efforts
- Benefits and trade-offs to the Klamath Tribes
- Number of workers
- Other agencies involved (such as Audubon Society and Sierra Club)
- Activities after exploration if a resource is found

The following concerns and issues were expressed by the Klamath Tribes representatives:

- The size of the proposed well pads and drilling holes
- Reclamation of well pads after project completion
- Potential for future geothermal development
- Potential for jobs
- Effect of project on spiritual use of the area
- Visual effects
- Increases in traffic

Concern was also expressed about the consultation process and who would be performing the consultation, and that the consultation be performed prior to a decision being made for the project. The Klamath Tribes group requested copies of the CEGC POO and the Calpine proposal for exploration at Fourmile Hill (see the discussion of cumulative effects in Section 4.12). Representatives of the Klamath Tribes said that Native Americans are uncomfortable with words such as "explore," "discover," and "develop," and these words cause concern to Native Americans because they reflect an exploitation of their resources.

The November 3 site visit with representatives of the Klamath Tribes included visits to the proposed 34-8TCH well pad, as well as the existing sites of well pads 68-8, 17-A6, and temperature gradient hole (TGH) 88-28. Questions were asked about the following topics during the site visit:

- Native American consultation and environmental documentation for existing well pads
- Purposes of various well pad facilities
- Effect from any leaks of drilling fluids contained in sumps
- The monetary benefit to the USFS of geothermal drilling
- Reclamation efforts
- Potential location of a power plant (although not currently proposed)

At the end of the site visit, the representatives of the Klamath Tribes expressed a desire to have more involvement in the consultation process, and requested a copy of the MOU between the USFS and BLM for proposed geothermal activities.

During the February 2 meeting with the Klamath Tribes, representatives of the tribes reiterated the concerns that were expressed at the October 18 meeting. The tribes representatives stressed the spiritual importance of the Medicine Lake area, and stated that they would be opposed to any project that would degrade or harm the area. The USFS inquired into the possibility of implementing restrictions (such as windows of operation or mandatory periods of no activity) to limit the potential effect of the proposed action on Native American uses in the area and to satisfy Native American concerns about the proposed action. The February 2 meeting ended with an understanding that the USFS would provide the Klamath Tribes with project-related information (i.e., site inventories, photographs, and an internal draft copy of the EA/IS), as well as other activities in the area (including geothermal) that the USFS has already permitted or is currently analyzing.

The USFS is continuing to solicit specific concerns from Native Americans, although no written comments have been received to date. Native Americans have expressed the desire to conduct consultations in person, rather than just through letters.

3.5 Biology

REGULATORY FRAMEWORK

The Federal Endangered Species Act (FESA) and the California Endangered Species Act (CESA) provide the general framework for the protection of endangered and threatened plant and animal species. An "endangered" species is defined as any species that is in danger of extinction throughout all or a significant portion of its range. This protection also extends to those species proposed for listing as threatened or endangered and those that are candidates for listing.

VEGETATION

The vicinity of the proposed action is a diverse area of moderately sloping to steep mountains, sinks, expanses of lava flows, and forested and logged lands. Elevation in the immediate vicinity of the proposed action ranges from approximately 6,200 feet above sea level near 63-20TCH to about 7,800 feet at Mount Hoffman and Red Shale Butte. Considerable structural diversity occurs in the region and is a result of past disturbances (primarily logging activities and fires) and site-specific conditions.

Special Status Species

No special status plant species have been identified or are known to occur at any of the proposed well pad sites or access road corridors. There are two special status plant species that have been located in the Medicine Lake Highlands: talus collomia (*Collomia larsenii*) and northern daisy (*Trimorpha acris* var. *debilis*) (Sanger 1995). The talus collomia grows on loose volcanic gravel; this type of habitat is not present at any of the well pad sites or

access road corridors. The northern daisy grows in lava outcrops in subalpine forests. The only known occurrence of this species is within Alcohol Crater (see Figure 1.1-2). Suitable habitat for the northern daisy is not present at any of the well pad sites or access road corridors (Wildlife Dynamics 1994).

General Vegetation

Two main forest types are found in the vicinity of the proposed action: lodgepole pine (*Pinus contorta*) and red fir (*Abies magnifica*). Dominant tree species include lodgepole pine, red fir, ponderosa pine (*Pinus ponderosa*), and white fir (*Abies concolora*). Understory is generally quite sparse, but occasional significant quantities of manzanita (*Arctostaphylos patula*) are present.

Most forest habitats in the vicinity have been harvested in the past, with only small pockets of "old growth" or unharvested timber stands remaining scattered throughout the vicinity of the proposed action. With the exception of well pad 46-32, all wells would be at least partially located on old log landings, logging roads, or in previously clear-cut areas that do not contain unharvested timber stands. Both even-aged and uneven-aged forest management practices have been conducted in the vicinity.

Table 3.5-1 provides a summary of vegetation at each of the TCH and exploratory well pad sites. Lodgepole pine and/or red fir dominate all of the well pad sites. In addition to these species, the most common tree species found at the well pad sites are white fir, ponderosa pine, and western white pine (*Pinus monticola*). Mountain hemlock (*Tsuga mertensiana*) can be found at the site of well 46-32.

Table 3.5-1 also provides an identification of habitat suitability for wildlife at each of the well pads. Wildlife habitat suitability is discussed in detail later in this section.

The proposed well pad sites and access road corridors are generally not located in timber stands that could be considered pure old growth forest. However, some old growth trees do exist on the sites of proposed wells 46-32 and 18-32, as well as in the access road corridor to the site of well 46-32; these proposed facilities are located in a previously unharvested area. In addition, there are old growth trees located on portions of well sites 58-6 and 56-18, which are in areas that have been subject to previous timber harvest.

General habitat components such as canopy closure, tree diameter at breast height (dbh), and snag densities differ at each well site (see Table 3.5-1). A brief description of vegetation at each of the proposed well sites and associated access road corridors follows.

34-8TCH

The site for well pad 34-8TCH is located entirely in a lodgepole pine regeneration stand on a previous log landing. Trees are from 6 to 15 feet tall and very dense. A logging debris pile forms the dead and downed (d/d) component at this pad. The access road to the well pad is an existing spur road that has been overgrown with lodgepole pine seedlings and saplings.

Table 3.5-1: Vegetation and Wildlife Habitat Suitability at Well Pad Sites[1]

Well Pad	Vegetation	Wildlife[2]
34-8TCH	Dominant species: lodgepole pine Canopy closure: 85% dbh[3]: 1 to 4 inches Snag density: 0 Previously cleared?: yes	American marten: MF[4] Mule deer: GHC
42-13TCH	Dominant species: lodgepole pine Canopy closure: 30% dbh: 3 to 8 inches Snag density: 1 per acre Previously cleared?: yes	Northern goshawk: SF Woodpeckers: MF[4] American marten: MF[4] Mule deer: SF
11-24TCH	Dominant species: lodgepole pine, red fir Canopy closure: 70% dbh: seed/sapling Snag density: 0 Previously cleared?: yes	American marten: MF[4] Mule deer: SF
15-15TCH	Dominant species: herbaceous vegetation Canopy closure: 0% dbh: n/a Snag density: 0 Previously cleared?: yes	American marten: MF[4]
63-20TCH	Dominant species: herbaceous vegetation Canopy closure: 0% dbh: n/a Snag density: 0 Previously cleared?: yes	American marten: MF[4] Mule deer: SF
18-32	Dominant species: lodgepole pine (center); lodgepole pine, red fir, western white pine (edges) Canopy closure: 50% (center); 65% (edges) dbh: seed/sapling (center); 1 to 40 inches (edges) Snag density: 0 (center); 4 per acre (edges) Previously cleared?: partially	Northern spotted owl: SF, MR[4] Northern goshawk: SF, SR Pileated woodpecker: SF, SR Woodpeckers: SF, SR American marten: SF, SR Mule deer: STC
46-32	Dominant species: lodgepole pine, red fir, western white pine, mountain hemlock Canopy closure: 55% (varies from 30% to 70%) dbh: 4 to 36 inches Snag density: 4 per acre Previously cleared?: no	Northern spotted owl: SF, MR[4] Northern goshawk: SF, SR Pileated woodpecker: SF, MR[4] Woodpeckers: SF, SR American marten: SF, SR Mule deer: STC
58-6	Dominant species: lodgepole pine Canopy closure: 35% dbh: seed/sapling to 18 inches Snag density: 0.5 per acre Previously cleared?: partially	Northern goshawk: MF, MR[4] American marten: MF[4] Mule deer: MTC[4]

Table 3.5-1: Vegetation and Wildlife Habitat Suitability at Well Pad Sites (continued)

56-18	Dominant species: lodgepole pine, red fir Canopy closure: 40% (highly variable) dbh: 1 to 32 inches Snag density: 2 per acre Previously cleared?: partially	Northern goshawk: SF Pileated woodpecker: SF Woodpeckers: SF, SR American marten: SF
13-18	Dominant species: lodgepole pine Canopy closure: 5% (center); 65% (edges) dbh: seed/sapling (center); 1 to 24 inches (edges) Snag density: 0 (center); 0.2 per acre (edges) Previously cleared?: partially	Northern goshawk: SF, SR American marten: SF Mule deer: STC, MF[4]

Notes:

[1]Includes proposed access road corridors where appropriate.

[2]Key to abbreviations: MF = marginally suitable for foraging; SF = suitable for foraging; MR = marginally suitable for reproduction; SR = suitable for reproduction; GHC = good hiding cover; MTC = marginally suitable for thermal cover; STC = suitable for thermal cover.

[3]dbh = diameter at breast height.

[4]Certain well pads contain habitat that is marginally suitable for a particular species; that is, the habitat contains at least two important habitat requirements for a species, but does not meet all of the minimum requirements to qualify as suitable habitat for the species. Well pads that contain marginally suitable habitat are identified in this table and are discussed in detail in the wildlife section.

SOURCE: Wildlife Dynamics 1994

42-13TCH

The site for well pad 42-13TCH is located entirely in an open, previously thinned, lodgepole pine stand. A scattered seedling and sapling layer of lodgepole pine is also present in the stand. Although snags tend to be less than 10-inch dbh, one 10-inch dbh snag is present in the pad site. D/d logs are common (approximately 20 per acre), but most are in an advanced decay stage. The majority of the proposed 1,500-foot access road (approximately 1,100 feet) to the well pad site would be located on an old spur road that has some regeneration lodgepole pine seedlings and saplings growing in it. The remaining 400 feet of the access road does not follow an existing road, but passes through a young, open stand of lodgepole pine with scattered red fir. Most trees in this area have a dbh of from 3 to 8 inches.

11-24TCH

The site for well pad 11-24TCH is located on an old log landing that is overgrown with red fir and lodgepole pine seedlings and saplings. The proposed access road to the well pad site is an existing spur road that has been overgrown with lodgepole pine and red fir seedlings and saplings.

15-15TCH

The site for well pad 15-15TCH is located on an old log landing and natural opening that is dominated by herbaceous vegetation. The pad site has one log debris pile. The proposed access road to the well pad site is an existing spur road that goes through the center of the well pad site.

63-20TCH

The site for well pad 63-20TCH is located on an old log landing that is dominated by herbaceous vegetation. The pad site has one log debris pile. The proposed access road to the well pad site is an existing spur road that goes through the center of the well pad site.

18-32

The site for well pad 18-32 is located partially on an existing temperature core hole well pad (28-32) and partially on an existing spur road. The existing pad measures approximately 100 feet by 200 feet and is overgrown with lodgepole pine seedlings and saplings. The existing spur road contains no vegetation. No d/d logs are found at the existing pad or in the road.

The remaining portion of the site for well pad 18-32 is a mature, multi-layered, forest dominated by lodgepole pine with red fir and very scattered western white pine. The forest in this area has not been previously harvested and contains old growth trees. Snags have a dbh of from 8 to 38 inches. D/d logs are common and vary in densities. Overall d/d densities are approximately 20 per acre.

46-32

The site for well pad 46-32 is located in a forested area that has not been previously harvested. The site is a mature, two-layered, lodgepole pine forest with scattered red fir, white pine, and mountain hemlock that contains old growth trees. Snags have a dbh of from 8 to 25 inches. D/d logs are common (approximately 20 per acre), but most are less than 14 inches in diameter and are in a state of advanced decay.

The proposed access road corridor to the well pad site also passes through a forested area that has not been previously harvested. The corridor connects the site well pad 46-32 to the existing USFS spur road that accesses the existing well pad 28-32 (and that accesses the site of proposed well pad 18-32). Vegetation within the access road corridor is generally the same as the vegetation at well pad 46-32.

58-6

The site of well pad 58-6 contains a mature lodgepole pine forest that has been commercially thinned at least once. Scattered larger trees at the site could be considered old growth. Snags appear to have been mostly felled in the area. D/d logs are common (approximately 25 per acre), but most are less than 14 inches in diameter. The proposed access road to the well pad site is an existing skid road that connects to an existing USFS spur road. Trees along the edges of the skid road are predominantly lodgepole pine.

56-18

The site of well pad 56-18 is centered on an area that has been subject to previous timber harvest activities that have removed many of the larger overstory trees. The area is a multi-layered, open canopy, forest dominated by red fir and lodgepole pine. The edges of the pad site have not been harvested as heavily as the center of the pad site. The trees at the edges therefore tend to be slightly larger in size and have a more closed canopy; some of these trees could be considered old growth. Snags have a dbh of from 8 to 25 inches. Scattered logging debris is the primarily d/d component. D/d densities are approximately 15 per acre. There are many old skid roads located throughout the site.

The proposed access road to the well pad site is an existing skid road with some regenerative lodgepole pine that connects to an existing paved County road. The route of the proposed access road passes through habitat similar to the center of the well pad site.

13-18

The site of well pad 13-18 is located in an existing clear-cut area that has been unsuccessfully replanted. This area has sparse lodgepole pine seedlings and saplings and covers approximately 70 percent of the proposed well pad site. The d/d component in the clear-cut area is primarily logging debris and debris piles, and d/d densities are approximately 15 per acre. D/d logs are generally less than 10 inches in diameter.

The remainder of the site of well pad 13-18 (on the north and south edges of the pad site) contains mature lodgepole pine that has been thinned by previous timber harvest activities. Herbaceous and shrub layers are lacking throughout this area. D/d logs densities are approximately 15 per acre. However, these d/d logs are mostly in an advanced state of decay and are generally less than 15 inches in diameter.

WILDLIFE

In order to identify the potential for wildlife species in the vicinity of the proposed action, a habitat assessment of the proposed well pads and access road corridors for wildlife species was conducted in September 1994 by Wildlife Dynamics (Wildlife Dynamics 1994). This habitat assessment supplemented wildlife surveys that have been conducted in the vicinity of the proposed action in the past (Gutiérrez 1993; Galea 1994). Protocols for habitat surveys were reviewed with USFS personnel to ensure acceptable data collection methods. In addition, the USFS has been consulted and a literature review was performed to identify specific animal species of concern. The following summarizes the results of these efforts.

Species of Concern

The Modoc National Forest provides habitat for more than 350 species of wildlife. Of these species, the USFS has listed a total of 37 species as Management Indicator Species (MIS) (see Table 3.5-2). These species require special management practices in order to ensure their viability. A description of the habitat requirements and management practices for

Table 3.5-2: Management Indicator Species in the Modoc National Forest

Species	Common Name	Scientific Name
Birds	Northern spotted owl[1]	*Strix occidentalis caurina*
	Northern goshawk[1]	*Accipiter gentilis*
	Hairy woodpecker	*Picoides villosus*
	Pileated woodpecker[1]	*Dryocupus pileatus*
	Bald eagle[1]	*Haliaeetus leucocephalus*
	Golden eagle	*Aquila chrysaetos*
	Willow flycatcher[1]	*Empidonax trailii*
	Canada goose	*Branta canadensis*
	Mallard	*Anas platyrhynchos*
	Swainson's hawk	*Buteo swainsoni*
	Osprey	*Pandion haliaetus*
	Prairie falcon	*Falco mexicanus*
	Peregrine falcon	*Falco peregrinus*
	Blue grouse	*Dendragapus obscurus*
	Sage grouse	*Centrocercus urophasianus*
	Sandhill crane	*Crus canadensis*
	Red-breasted sapsucker	*Sphyrapicus ruber*
	Red-naped sapsucker	*Sphyrapicus nuchalis*
	Yellow warbler	*Dendroica patechia*
Mammals[2]	American marten[1]	*Martes americana*
	Mule deer[1]	*Odocoileus hemionus*
	Western gray squirrel	*Scriurus griseus*
	California bighorn sheep	*Ovis canadensis*
	Pronghorn	*Antilocapra americana*
	Small-footed Myotis bat[1]	*Myotis subulatus*
	Long-eared Myotis bat[1]	*Myotis ebotis*
	Long-legged Myotis bat[1]	*Myotis volans*
	Fringe Myotis bat[1]	*Myotis thysanodes*
	Yuma Matis bat[1]	*Matis*
Fish	Modoc sucker	
	Lost River sucker	*Deltistes luxatus*
	Shortnose sucker	*Chasmistes brevirostes*
	Goose Lake redband trout	*Onchorhynchus mykiss*
	Rainbow trout	*Onchorhynchus mykiss*
	Brook trout	*Salvelinus fontinalis*
	Brown trout	*Salmo trutta*
	Largemouth bass	*Micropterus salmoides*

Notes:

[1]These Management Indicator Species (MIS) have been identified by the USFS as species that could occur in the vicinity of the proposed action and be affected by the proposed action.

[2]Although not identified as a mammal MIS, the USFS has expressed management concern over the Pacific western big-eared bat, which could occur in the vicinity of the proposed action.

SOURCE: USFS 1991a; Wildlife Dynamics 1994

each of the MIS is provided in the USFS's *Modoc National Forest Land and Resource Management Plan* (USFS 1991a). Consultations with the USFS identified the following 12 MIS with the potential to occur in the vicinity of the proposed action that could potentially be affected by the proposed action (Ratcliff 1993-1995; Sharp 1993-1995):

- Northern spotted owl
- Northern goshawk
- Pileated woodpecker
- Bald eagle
- Willow flycatcher
- American marten
- Mule deer
- Small-footed, Long-eared, Long-legged, and Fringe Myotis bats
- Yuma Matist bat

Although other MIS are not considered to occur in the immediate vicinity of the proposed action, habitat suitability for all MIS was considered during the habitat assessment of the proposed well pads and access roads. The USFS required that the suitability of reproductive and foraging habitat for species of concern be determined by ground truthing and aerial photograph interpretation. Criteria for establishing habitat suitability was provided by the USFS (Villegas 1994) and through a review of current literature and the *Modoc National Forest Land and Resource Management Plan* (USFS 1991a).

In addition to the 12 MIS, the USFS expressed management concern over all woodpecker species (specifically regarding reductions in snag density levels) and the Pacific western big-eared bat (Ratcliff 1994). A discussion of the species with the potential to occur in the vicinity of the proposed action follows.

Northern Spotted Owl: The northern spotted owl is designated as a state endangered and a federal threatened species. The project area is located on the extreme eastern edge of the range of the northern spotted owl, which includes areas in western Washington and Oregon, as well as northwestern California (USFS and BLM 1994a). The owl forages primarily in areas that have stands of mature conifers (i.e., old growth forests) possessing a canopy closure greater than 40 percent, with dominant trees having a mean diameter at breast height (dbh) of 11 to 22 inches. The owl also prefers mature conifer stands for reproductive habitat. Other reproductive habitat requirements for the northern spotted owl include a canopy closure greater than 40 percent and a dominant tree mean dbh of greater than 22 inches.

Northern Goshawk: The northern goshawk is considered to be a California Species of Special Concern. The goshawk is difficult to detect, and is not tolerant of human activity. This species prefers to forage in wooded areas (particularly mature and old-growth stands of conifer and deciduous habitats) interspersed with meadows and other openings. The species uses snags and dead-topped trees for observation and prey-plucking perches. The goshawk usually nests near water and uses a mix of any tree species (including pure lodgepole) with a canopy closure greater than 50 percent as nesting habitat. At least some

of trees must have a dbh greater than 12 inches and be at least 40 feet tall to serve as potential nest trees.

Pileated Woodpecker: The pileated woodpecker prefers mostly mature stands of mixed conifer with a canopy closure greater than 50 percent as reproductive habitat. Pileated woodpeckers also requires snags with a dbh of 10 to 24 inches at a density of at least 1.5 snag per acre, as well as snags with a dbh greater than 24 inches at a density of at least 0.25 snags per acre.

Woodpecker (other): Most woodpecker species are dependent on snags for foraging and/or reproductive habitat. Snags with a dbh greater than six inches at a density of at least two snags per acre is considered to be suitable habitat for woodpecker species.

Bald Eagle: The bald eagle is a state and federal endangered species. This species typically forages on large water bodies or free-flowing rivers with abundant fish populations and with adjacent snags or other perches. In winter months, carrion and waterfowl become important food items, particularly in the Klamath Basin. This species prefers to nest within one mile of a permanent water source. The bald eagle generally nests in large old-growth tree stands with less than 40 percent canopy closure. Nests are usually located 50 to 200 feet above ground.

Within the vicinity of the proposed action, densities of bald eagles are considered to be low. The area encompassing Medicine Lake and Medicine Mountain has been designated as a bald eagle management area (BEMA). A nesting eagle pair has been identified in this area. In addition, winter roost areas for the bald eagle are located five to 10 miles north of the proposed action. Roosting has also been documented to the west of Mount Hoffman, which is located north of the proposed action.

Willow Flycatcher: The willow flycatcher uses deciduous tree and shrub thickets associated with riparian and meadow habitat types. The distribution of this species on the Modoc National Forest is unknown, but it is thought to occur in willow stands associated with meadows throughout the Forest. Sightings have occurred in the South Warner Mountains and the Modoc National Wildlife Refuge, both over 25 miles to the east of the proposed action.

American Marten: The American marten is designated as a California Species of Special Concern that was once trapped for its valuable fur. This species is considered to be an uncommon species that frequents semi-secluded forest tracts, and is difficult to detect. The marten prefers mostly mature stands of mixed conifer in semi-arid areas with the presence of some large diameter snags, as well as stumps and logs near meadows and riparian areas. The marten requires an abundant downed-log component in its reproductive habitat, preferably of relatively large diameter and with root wads. Red fir and lodgepole pine are considered to be suitable habitat for the species.

Mule Deer: Mule deer in the vicinity of the proposed action are considered to be a part of the Glass Mountain deer herd. The vicinity of the proposed action is in the summer range

of the deer due to its high elevation. Deer require an interspersion of thermal cover (mature tree canopy) and forage areas (open canopy forest, openings, or early successional communities) throughout the year. This type of interspersion is typical in the vicinity of the proposed action. Habitat quality for mule deer is considered to be decreased in areas where road densities are greater than 1.5 miles of open roads per square mile and where forest practices have reduced or eliminated preferred browse plant species.

Bats: The Pacific western big-eared bat is considered to be a California Species of Special Concern, and the small-footed, long-eared, long-legged, and fringe Myotis bats and Yuma Matist bat are MIS. These species prefer caves that have "full-dark" zones and air ventilation. The Myotis and Yuma Matist bats also use large Shasta red fir, Ponderosa pine, or similar type tree snags with thick, loose, and flaky bark as habitat. Evidence of bat habitation is usually indicated by droppings and food remnants such as insect parts.

Wildlife Survey Results

Table 3.5-1 summarizes the results of the wildlife habitat assessment for the proposed action by well site. For each of the proposed well sites, the specific wildlife species that could use the well pad site as habitat are identified, and the quality and type of habitat that is present at the well pad site for the species is noted. The following is a discussion by wildlife species of the suitability of the well sites as habitat for each species that has been identified as a species of concern for the proposed action by the USFS.

Northern Spotted Owl: Proposed well pads 18-32 and 46-32 provide suitable foraging habitat and marginally suitable reproductive habitat for the northern spotted owl. Although well pad 18-32 does not meet all of the owl reproductive habitat requirements, the well pad is considered to be marginal reproductive habitat since trees and snags greater than 22 inches dbh are present (but not dominant) and since the canopy closure is greater than 40%. Well pad 46-32 has similar characteristics as pad 18-32, and is located in an unharvested, unroaded mature conifer forest; well pad 46-32 is therefore designated as marginal reproductive habitat although it does not meet all of the owl reproductive habitat requirements.

Northern spotted owl surveys in accordance with U.S. Fish and Wildlife Service (USFWS) protocol were conducted in the project vicinity in 1992 and 1994 (Gutiérrez 1993; Galea 1994). These surveys included all of the proposed well pad and access road locations except for pad sites 63-20TCH and 15-15TCH (see Figure 1.1-2). One spotted owl detection was made during the 1992 survey. Follow-up callings did not receive a response, and the detected owl was therefore determined to just be passing through the vicinity. The 1992 survey indicated that there are no resident owls in the project vicinity, and that the project vicinity is not within any owl home ranges (Gutiérrez 1993). No owls were detected during the 1994 survey, which confirmed the conclusion of the 1992 surveys that there are no resident owls in the project vicinity and that the project vicinity is not within any owl home ranges (Galea 1994).

Northern Goshawk: All of the exploration well pad sites and one of the TCH well pad sites provide habitat for this species. Suitable foraging habitat can be found at the site of 42-13TCH and at all of the exploration well pad sites except for 58-6. Exploration well pads 18-32, 46-32, and 13-18 provide suitable reproductive habitat for the goshawk.

Marginally suitable foraging and reproductive habitat for the northern goshawk can be found at the site of well pad 58-6. Although this well pad does not meet all of the goshawk habitat requirements (particularly the requirement for a minimum of 50% canopy closure), the well pad is considered to be marginal habitat since dominant trees at the pad are greater than 12 inches dbh.

The 1994 survey for spotted owl also included a survey for the northern goshawk in accordance with USFS protocol (Galea 1994). As noted above, this survey included all of the proposed well pad and access road locations except for pad sites 63-20TCH and 15-15TCH. Three goshawk detection were made during the 1994 survey. Since follow-up callings did not receive a response and goshawk nests were not found in the vicinity, the detected goshawks were determined to just be passing through the vicinity (Galea 1994).

Pileated Woodpecker: Habitat for the pileated woodpecker can be found at well pad sites 18-32, 46-32, and 56-18. All three of these well pad sites provide suitable foraging habitat for this species. The site of well pad 18-32 contains suitable reproductive habitat, while the site of well pad 46-32 provides marginally suitable reproductive habitat. Well pad 46-32 is considered to be marginal habitat since the densities of large-diameter snags is below the minimum requirements, but this habitat component is present on the pad and in surrounding habitats.

Woodpecker (other): Similar to the pileated woodpecker, habitat for other woodpecker species can be found at well pad sites 18-32, 46-32, and 56-18. All three of these proposed well pads provide suitable foraging and reproductive habitat for woodpeckers. In addition, the site of 42-13TCH provides marginally suitable foraging habitat for woodpeckers. This TCH well pad is considered to be marginal habitat since snags are present at the pad, but at densities below the minimum requirement of two snags per acre.

Bald Eagle: The bald eagle was not observed in the vicinity of the proposed action, and the proposed well pad sites and associated access road corridors generally do not provide habitat that is considered suitable for the species. There are no known bald eagle nesting or foraging areas in the immediate vicinity of the proposed well pad sites or access road corridors (Ratcliff 1993-1994).

Well pad site 11-24TCH is located just within the southeastern corner of the BEMA, and site 15-15TCH is located to the west of the western boundary of the BEMA. However, the nesting eagle pair identified in the BEMA is not known to use the habitats in the vicinity of these proposed well pad sites (Ratcliff 1993-1994). In addition, these well pad sites are not considered to be suitable habitat for the species.

Willow Flycatcher: The willow flycatcher was not observed in the vicinity of the proposed action, and suitable habitat does not exist at the proposed well pad sites or access road corridors.

American Marten: All of the proposed well pad sites provide some form of habitat for the American marten. Suitable foraging habitat can be found at all of the exploration well pad sites except for 58-6. Well pad sites 18-32 and 46-32 provide suitable reproductive habitat for the marten.

Marginally suitable foraging habitat for the American marten can be found at the site of well pad 58-6 and at all of the TCH well pad sites. Well pad 58-6 is designated as marginal foraging habitat since the pad contains large debris piles and some rock crevices that could be used by marten for denning, but the pad has a variable canopy cover and evidence of past human disturbance. The TCH well pad sites are considered to be marginal foraging habitat since the pad sites contain debris piles and/or a conifer canopy, but do not meet all of the marten foraging habitat requirements.

Mule Deer: All of the proposed well pad sites are within the summer range of the mule deer. Since mule deer are generalist species (in terms of habitat), most of the proposed well pad sites provide at least marginal cover or foraging habitat. The site of 34-8TCH could provide good hiding cover for mule deer. Well pad sites 18-32, 46-32, and 13-18 provide suitable thermal cover. Well pad sites 42-13TCH, 11-24TCH, and 63-20TCH contain suitable foraging habitat for mule deer.

The site of well pad 58-6 provides marginally suitable thermal cover, and the site of well pad 13-18 provides marginally suitable foraging habitat. Well pad 58-6 is considered to provide marginal thermal cover since the pad meets some of the requirements for thermal cover for the mule deer, but has a slightly deficient and variable canopy cover. Well pad 13-18 is designated as marginal foraging habitat since the pad contains only a limited diversity of browse plant species for deer foraging.

Bats: Bat species were not observed in the vicinity of the proposed action, and no suitable caves was found at the proposed well pad sites or access road corridors for these species. Habitat requirements for the Myotis and Yuma Matist bats (i.e., large snags with thick, loose, and flaky bark) were not specifically surveyed for during the habitat assessment. However, based on the vegetation at each of the well pads (see Table 3.5-1), there is the potential for this habitat at only three of the well pads: 18-32, 46-32, and 56-18.

3.6 Air Quality

METEOROLOGY

The climate of the project region is temperate and semiarid, characterized by relatively hot and dry summers and cool and moist winters and springs. Climatic conditions vary considerably in the region, depending primarily on elevation. Recorded temperatures in the project vicinity have ranged from -8°F in the winter to 101°F in the summer. The

average annual precipitation in the vicinity of the proposed action is about 43 inches per year, but ranges from about 35 to more than 45 inches per year. Much of the precipitation occurs as snowfall that infiltrates into the subsurface as it melts.

Winds in the vicinity of the proposed action are highly variable and are affected by regional wind patterns and topography. Mount Shasta, located approximately 40 miles southwest of the proposed action, influences weather patterns over the entire region. Gusty winds of high velocity can occur in the region, with storm gusts occasionally exceeding 60 miles per hour (mph). Winter snowstorms generally bring winds blowing from the southwest or northwest. In the Lava Beds National Monument to the north of the proposed action, dry winds from the northwest prevail. The vicinity of the proposed action is subject to severe thunderstorms during the late spring months and the summer months, with storms building up over the cooler Medicine Lake Highlands.

REGULATORY FRAMEWORK

Federal, state, and local requirements and standards provide regulation of air quality in the vicinity of the proposed action.

Federal

The Federal Clean Air Act (CAA) required the U.S. Environmental Protection Agency (EPA) to identify ambient air quality standards (AAQS) to protect public health and welfare. Federal AAQS have been set for the following pollutants: total suspended particulate (particulate matter less than 10 microns [PM_{10}]), carbon monoxide (CO), oxides of nitrogen (NO_x), ozone (O_3), sulfur dioxide (SO_2), and lead (Pb). These pollutants are called "criteria" pollutants because the standards satisfy criteria specified in the CAA. Federal AAQS are identified in Table 3.6-1.

Pursuant to the CAA, 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 AAQS have been achieved. Air basins that have not received sufficient analysis for certain criteria air pollutants are designated as "unclassified" for those pollutants. The EPA has designated Siskiyou County as unclassified for all criteria pollutants.

In addition to the Federal AAQS, the CAA has also designated areas within the United States as either Class I or Class II air quality areas. Class I areas are national parks and wilderness areas of a given size that were in existence prior to 1977 or have since been redesignated (40 CFR 52.21). Class I is the most stringent air quality category and was assigned by Congress to prevent further deterioration of air quality in these areas. Class II areas are all of the remaining areas outside of the Class I area boundaries.

In the vicinity of the proposed action, there are two wilderness areas totaling 28,460 acres that are designated as Class I areas. Both of these wilderness areas are located in the Lava Beds National Monument and are designated as the Lava Beds National Wilderness Area. The remainder of the vicinity of the proposed action is designated as Class II areas.

Table 3.6-1: State and Federal Ambient Air Quality Standards

Pollutant	Averaging Period	California Standards ($\mu g/m^3$)[1]	Federal Standards ($\mu g/m^3$)
PM_{10}	24-Hour	50	150
	Annual	30	50
NOx (as NO_2)	1-Hour	470	–
	Annual	–	100
SO_2	1-Hour	655	–
	3-Hour	–	1300
	24-Hour	105	365
	Annual	–	80
CO	1-Hour	23,000	40,250
	8-Hour	10,350	10,350
O_3	1-Hour	180	235
Pb	30-Day	1.5	–
	Quarterly	–	1.5
H_2S	1-Hour	42	–

Notes:
[1] $\mu g/m^3$ = micrograms per cubic meter

SOURCE: California Air Resources Board 1991

State and Local

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 (APCDs). In addition, CARB has established state AAQS (see Table 3.6-1). The state AAQS are generally more stringent than the Federal AAQS. Under the California Clean Air Act (which was patterned after the Federal CAA), areas have been designated as attainment, non-attainment, or unclassified with respect to state ambient air quality standards. Siskiyou County is considered unclassified for the state AAQS for all criteria pollutants (CARB 1992).

The Siskiyou County Air Pollution Control District (SCAPCD) is responsible for local regulation of air quality. New sources of air pollutants must acquire an Authority to Construct (ATC) and a Permit to Operate (PTO) from the SCAPCD.

EXISTING AIR QUALITY

The air in the vicinity of the proposed action is considered to be of excellent quality. There are very few significant pollutant sources in the vicinity of the proposed action, and background concentrations of criteria air pollutants are considered to be low. Of the criteria air pollutants, particulate matter is of the greatest concern, primarily in the summer months. During these months, wildfires, controlled burns for forest management and logging, and agricultural burning are the principal activities in the vicinity of the proposed action that generate airborne fugitive dust. Mineral extraction operations and

agricultural activities in the vicinity also occasionally contribute to particulate matter emissions in the region during the summer.

3.7 Noise

REGULATORY FRAMEWORK

The Federal GROs (no. 4) define limits for noise from geothermal activities. Noise levels must be 65 dBA or less at the lease boundary or 0.5 miles from the source, whichever is greater.

NOISE LEVELS

In general, 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 man-made 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 and snowmobiles) in the area is also occasionally audible.

Ambient noise levels include intermittent noise from previously authorized geothermal activities.

3.8 Visual Resources

The vicinity of the proposed action is characterized by a diversity of distinct land forms and vegetation that is relatively undisturbed by man-made features. The volcanic history of the area has resulted in dramatic geologic features such as volcanic rims, cinder cones, collapsed lava tubes, lava flows, and volcanic craters. The topography in the vicinity of the proposed action is extremely varied, which provides vista and vantage points throughout the region. Although logging activities have occurred in the vicinity of the proposed action, the area remains heavily forested. The combination of these features provides the unique scenic qualities of the area.

The primary influence of humans on the visual landscape in the immediate vicinity of the proposed action has been through recreational, timber harvesting, and geothermal activities. Recreational activities have resulted in the establishment of campgrounds, summer homes, and support facilities, which are visible primarily near Medicine Lake. Timber harvesting and logging activities have resulted in cleared areas throughout the vicinity of the proposed action.

Previous authorized geothermal drilling activities have also resulted in cleared areas for well pads within the Glass Mountain KGRA. The cleared areas associated with geothermal drilling activities are generally smaller in size than those areas cleared by timber harvests. Logged areas have been used for geothermal drilling well pads.

In order to protect visual resources in the Modoc National Forest, the USFS has established five visual quality objectives (VQOs) for the Forest. All areas within the Forest have been assigned a VQO. The primary areas of concern are those areas designated as preservation or retention VQOs. In preservation VQO areas, only ecological changes are permitted. In retention VQO areas, activities may occur that are not visually evident to the casual observer. In determining if a proposed use would meet the preservation or retention VQOs, the following aspects of the proposed use are considered:

- The nature of the proposed use
- The physical capability of the landscape to absorb the modification associated with the proposed use
- The visual sensitivity of the area

The other three VQOs are partial retention, modification, and maximum modification. Areas with these designations allow increasing levels of visual modification from activities. Table 3.8-1 identifies the VQO designations for each of the proposed well pad sites. None of the proposed facilities would be located in an area with a preservation designation.

Table 3.8-1: VQO Designations for Proposed Well Pad Sites[1]

Well Pads	Visual Quality Objective
34-8TCH	Modification
42-13TCH	Partial Retention
11-24TCH	Partial Retention
15-15TCH	Partial Retention
63-20TCH	not designated
18-32	Retention
46-32	Partial Retention
58-6	Modification
56-18	Retention
13-18	Partial Retention

Notes:

[1]Proposed access road corridors to well pads generally have the same VQO designation as the well pad.

SOURCE: USFS 1991a

3.9 Land Use, Recreation, and Transportation Systems

LAND USE

The vicinity of the proposed action is generally an undeveloped, forested area that has relatively little human occupation and provides a variety of recreational opportunities. The area is also used for selective commercial logging activities. The few residential uses that exist in the vicinity of the proposed action are primarily summer homes clustered near Medicine Lake. The inaccessibility of the region during the winter months due to snow limits the land uses in the area.

Well pad sites 18-32 and 46-32 are located in the USFS-designated Mount Hoffman Roadless Release Area (RRA). The RRA is a 10,800-acre area located north of Medicine Lake that has been provided protection by the USFS. RRAs are areas that have been released from current consideration for designation as Federal Wilderness Areas, but that could be considered for Wilderness Area designation at a later date.

The proposed action would be located on Federal Geothermal Leases CA-12367, CA-12370, CA-12371, CA-12372, CA-1224, and CA-2500. Of these six leases, four (CA-12367, CA-12370, CA-12371, and CA-12372) carry special stipulations that restrict surface occupancy within portions of the lease areas. These special stipulations, referred to as "no surface occupancy" lease stipulations, prohibit occupancy by a proposed action of specified portions of the leases if the action would result in significant adverse impacts. If it can be proved that there would not be a significant adverse impact from a proposed action, the no surface occupancy restriction would be lifted.

The no surface occupancy stipulations on portions of CA-12367 and CA-12372 apply to areas within these leases that are either on or in the vicinity of the Glass Mountain lava flow. The stipulations prohibit occupancy unless it can be demonstrated that the proposed action would not have a significant adverse impact on this unique lava flow and associated geologic features. The no surface occupancy stipulations on portions of CA-12370 and CA-12371 are related to protection of recreational uses. The stipulations prohibit occupancy unless it can be demonstrated that the proposed action would not have a significant adverse impact on recreational uses. Of the 10 proposed well pads, only well pad 42-13TCH is located within a no surface occupancy lease stipulation area (related to recreational uses).

The project area does not include any farmland or Areas of Critical Environmental Concern.

RECREATION

In the vicinity of the proposed action, there are two types of USFS-designated recreational areas: developed recreation areas and dispersed recreation areas.

Developed Recreation Areas

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. All of the proposed well pads (except for 63-20TCH, 18-32, and 46-32 and associated access roads) would be located within the RMA.

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

- Medicine Lake Campground (22 camp sites)
- A.H. Hogue Campground (24 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 ever full.

In addition to the camp areas around Medicine Lake, a public day-use picnic area, swimming area, and boat launching ramp are located on the southeastern shore of the lake. Other developed recreational facilities at Medicine Lake include three recreation residences (under special use permit from the USFS) and about 100 recreation residences located on private lands adjacent to the lake. 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

The proposed locations of well pads 63-20TCH, 18-32, and 46-32 are outside of the RMA, and are thus considered to be located in dispersed recreation areas. These areas have not been (and are not planned to be) developed for intensive recreation use. Big game hunting and recreational driving on the many primitive roads in the Modoc National Forest are the primary recreational activities that occur in dispersed recreation areas. Camping, nature study, hiking, and off-road vehicle use are other typical recreational activities that occur in these areas.

June through October are the primary months of dispersed recreation area use due to cold weather and snow during other times of the year. However, dispersed recreation areas are used during the late fall, winter, and spring months for recreational activities such as cross-country skiing and snowmobiling.

TRANSPORTATION

The vicinity of the proposed action is well accessed by several existing paved and gravel-surfaced arterial roads, as well as many gravel-surfaced collector roads. Traffic volumes roads in the vicinity are very low and are typical of rural areas with sparse human populations. The primary access routes in the vicinity are:

- Medicine Lake Highway (Modoc County Road 97), a paved two-lane arterial providing access from State Highway 139 to the east of the proposed action
- Powder Hill Road (43N49), a paved two-lane arterial providing access from State Highway 89 through the Shasta National Forest to the southwest of the proposed project area. This arterial also connects with 42N24, an arterial providing access from Modoc County Road 91 to the southeast of the proposed action
- Lava Beds Monument Road (47N75) a partially paved, partially gravel-surfaced, primarily single-lane (with turn-outs) arterial providing access from the Klamath Basin to the north of the proposed action through the Lava Beds National Monument
- Davis Road (45N05) a paved two-lane arterial providing access from Macdoel to the west of the proposed action on the Klamath National Forest

There are also several gravel-surfaced roads that criss-cross the vicinity of the proposed action, 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 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 pads. Travel on area roads occurs primarily during the summer months since this is the period of highest Forest use.

With the exception of the site of well pad 46-32, all of the proposed well pads are currently connected by existing spur roads or old logging skid roads to improved roads in the vicinity of the proposed action. However, only well sites 15-15TCH, 63-20TCH, and 13-18 are currently accessible by vehicle. The existing access routes to the remaining well pads have been overgrown with vegetation and require varying degrees of improvement to provide adequate access for project trucks and vehicles (see Table 2.1-1).

In the immediate vicinity of Medicine Lake, the USFS has paved some roads (such as 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. The USFS is concerned that heavy truck loads could break up and destroy the pavement along these roads (Sharp 1994).

3.10 Socioeconomics

POPULATION

As of 1992, the population of Modoc County was 10,130, and the population of Siskiyou County was 44,791 (California Department of Finance 1992). Population growth rates in

Modoc and Siskiyou Counties from 1980 to 1990 were 12% and 13% respectively. In-migration accounted for 75% to 80% of the increase. This pattern is consistent with national trends showing movements from urban areas to more rural settings.

The population of Modoc and Siskiyou Counties are expected to increase at an average annual rate of 1.3% and 0.8% respectively. Both Modoc and Siskiyou County populations are expected to increase at rates below the anticipated statewide annual growth rate of 1.8%.

The average age of the population in Modoc and Siskiyou Counties is increasing as a result of a poor job market in the 18- to 24-year-old group, and the in-migration of older-age groups (primarily for retirement). Modoc and Siskiyou Counties have higher percentages of people in the 50-and-older age class (33% and 32%, respectively) than the rest of the State (25%).

The 1990 census reports the population density of Modoc County to be 2.4 people per square mile and 7.1 in Siskiyou County. These population densities are considered sparse when compared to the state average of 156 people per square mile.

EMPLOYMENT

The principal economic resources of Modoc and Siskiyou Counties are government employment, timber, agriculture, and recreation (see Table 3.10-1). The National Forest affects the agricultural sector by supplying livestock forage on public lands, which many ranches include as an integral part of their total operations. Recreation, particularly hunting, fishing and camping on forest land, affects the wholesale and retail trade and services sectors. Within the manufacturing sector, lumber and wood products (timber harvesting and mill work) comprise over 90% of total manufacturing employment. Timber also has a strong effect on the construction sector due to road construction and reconstruction requirements to transport harvested lumber.

Table 3.10-1: Comparison of Percent Employment by Sector

Economic Resource	Modoc County (%)	Siskiyou County (%)	State (%)
Government	36	30	16
Agriculture and Forestry	12	6	<2
Wholesale and Retail Trade	16	22	24
Services	23	16	27
Manufacturing	6	15	18
Construction	<5	<5	<2

SOURCE: USFS 1991a

Unemployment rates in Modoc and Siskiyou Counties are subject to seasonal fluctuations. Unemployment reaches a peak during winter months when harsh weather hampers timber harvesting, farming, and ranching. In-migration from urban areas has occurred at a faster rate than employment opportunities have increased and has contributed to the high unemployment rates in Modoc and Siskiyou Counties. Between 1982 and 1989, Modoc and Siskiyou County unemployment rates in exceeded Statewide averages for the same period. During this time, Modoc County's unemployment rate ranged from 7% to 12%, Siskiyou County's unemployment rate ranged from 11% to 23%, and the state's unemployment rate ranged from 5% to 10%.

HOUSING

The total housing in Modoc County in 1992 was 4,791 housing units, which includes 1,090 mobile homes. The 1992 vacancy rate in Modoc County was 20.08% (California Department of Finance 1992). Modoc County's housing supply is divided into the unincorporated County of Modoc and the City of Alturas. Approximately 73% of the households in unincorporated Modoc County are owner occupied and 27% are renter occupied. Alturas households are 64% owner occupied and 36% renter occupied (Modoc County 1993).

Additional temporary housing in Modoc County consists of 10 recreational vehicle parks (RV parks) and 11 motels (Heiser 1994). Alturas has four trailer parks, one RV park and nine motels (Heiser 1994; Taylor 1994). Motels are also located nearby in the towns of Cedarville and Canby. There are 24 campgrounds in the Modoc National Forest that provide approximately 300 camp sites. These campgrounds are open during only the summer and early fall months. Four of these campgrounds, providing 73 camp sites, are located in the immediate vicinity of the proposed action (see Section 3.9, Land Use, Recreation, and Transportation Systems).

The total housing in Siskiyou County in 1992 was 20,535 housing units, which includes 3,642 mobile homes. The 1992 vacancy rate in Siskiyou County was 13.33% (California Department of Finance 1992). Additional temporary housing in Siskiyou County consists of approximately 20 RV Parks, and over 78 inns and motels (Breedon 1994; Ward 1994).

There are about 100 residences in the vicinity of the proposed action. These homes are used as recreational or second homes and are not occupied year round. The homes closest to the proposed action are approximately one to two miles away and are located on the southwest shore of Medicine Lake. Property values of these homes range from about $30,000 to $125,000 and depend on the condition of the home, type of property improvements, and the date of the last property appraisal (Sharp 1994).

4: ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

4: ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

4.1 Introduction

This chapter describes the expected environmental effects of the four alternatives, including the proposed action. The discussion focuses on those effects that could potentially be significant and/or were raised during the public scoping period for the POO. For each effect, the significance of the effect is discussed, and any necessary mitigation measures to reduce the effect and ensure that the effect would not be significant are identified. Significance criteria for each parameter are based primarily on Appendices G and I of CEQA. The analysis of the impacts of Alternatives B, C, and D focuses on the effects that would be different from those identified for the proposed action (Alternative A). A Mitigation Monitoring and Reporting Program (MMRP) for the proposed action is provided in Appendix C.

4.2 Geology and Soils

SIGNIFICANCE CRITERIA

Geology-related impacts that could be considered significant include:

- Topographic changes which lead to other adverse impacts (e.g., visual impacts or impacts on slope stability)
- Adverse affects on unique geologic or topographic features
- Substantial subsidence
- The prevention of the recovery of significant mineral resources

- Exposing people or structures to major geologic hazards
- Causing substantial erosion or siltation

EFFECTS OF ALTERNATIVE A

4.2.1. Geologic Hazards

Slope Stability: All of the proposed project facilities would be located in areas of gentle to moderate slopes of under 30% and in areas of stable soil types. The proposed action would therefore not cause or be affected by unstable soils or slopes.

Seismicity: The proposed action would not cause an increase in seismicity in the area. Induced seismicity is generally related to injection of geothermal fluids under high pressure. For example, at the Denver Arsenal, injection of fluids at 8,000 to 10,000 pounds per square inch (psi) was found to increase seismicity (Colorado School of Mines 1967). However, the proposed action would not involve the injection of geothermal fluids under high pressure. There would be limited volumes of geothermal fluids produced, and high-pressure injection is not proposed during the exploration and testing phase of the proposed action. If any fluids were returned to the reservoir, they would be injected under atmospheric pressure or at very low pressures of only a few pounds. Experience at the Coso and other geothermal fields has shown that geothermal exploration has not increased the level of earthquakes felt by humans in the region.

Ground shaking associated with a seismic event in the region would not damage the subsurface casings. Fill slopes would be compacted to reduce the effect of ground shaking. The equipment associated with drilling rigs and well testing is not considered to be excessively hazardous during seismic events. Workers would therefore not be exposed to excess level of hazard during drilling or testing operations.

Volcanic Hazard: The proposed action is located in a potentially active volcanic area, but would not increase the potential for volcanic hazards. The USGS indicates that an eruption of the Medicine Lake Highlands would be similar to previous eruptions—comparatively non-catastrophic. Based on that assumption, some general hazards associated with such an eruption can be predicted.

From a geologic perspective, a volcanic eruption in the area would not be expected to be violent. An eruption would be accompanied by gases and deposits of ash, pumice, and cinders. The amount of deposit could be 20 to 50 feet deep, depending on the distance from the source of the eruption. Surface flows of hot molten lava and mud would not be expected to be extensive. As mud flows are ejected from a volcano, they pick up more water as they melt snow, slide through lakes, and eventually flow down exiting drainages. Mud flows occurring as a result of an eruption in the Highlands would not be extensive because few drainages exist in the area.

Because the proposed action is located in a potentially active volcanic area, CEGC employees in the vicinity would be exposed to risk from potential volcanic eruption. However, hazards to workers would be considered extremely remote due to the

infrequency of potential volcanic eruptions and the limited life span of the proposed action. If there is any indication during the life of the proposed action that a volcanic eruption is imminent in the vicinity of the proposed action, CEGC would comply with employee evacuation procedures specified by the USGS, USFS, and BLM. Volcanic events would not be expected to affect wells.

4.2.2. Erosion

Although grading for construction of well pads and roads has the potential to increase erosion, CEGC would prevent erosion through the use of careful site preparation procedures. Standard construction techniques for control of runoff from construction sites would be employed, and construction would be designed to avoid changing existing drainage channels.

At well pads, berms and culverts would be installed if necessary to control erosion and drainage. Pads would be constructed to channel drainage into the sump. Since the pad sites are relatively level, no steep cut or fill slopes would be required. Pad fill slopes would be compacted to reduce gullying and erosion. Topsoils would be stockpiled and spread on slopes to aid in natural revegetation. Upon abandonment, the sites would be restored to their original condition as far as practicable. Any stockpiled topsoil would be replaced and the site would be reseeded and planted to minimize the potential for erosion. Construction and use of well pads would therefore not significantly increase the potential for erosion.

For construction of roads, erosion would be controlled by using Best Management Practices (BMPs). Water bars, outslope roads, road ditches, and rocked drainages would be used for erosion control along roads. Upon completion of the project, roads that would be abandoned would be restored to their original condition as far as practicable. Road corridors would be reseeded and planted to minimize the potential for erosion. Construction and use of roads would therefore not significantly increase the potential for erosion.

4.2.3. Subsidence

Subsidence is a potential hazard associated with the withdrawal of geothermal fluid from a reservoir. However, due to the limited volume of geothermal fluids that would be produced during well testing, and the demonstrated competence of the volcanic rocks in the region, no subsidence is expected to result from the proposed drilling and testing.

4.2.4. Topography

The proposed action would involve grading up to five TCH well pads measuring approximately 60 feet by 100 feet, five exploration well pads measuring approximately 400 feet by 600 feet, and approximately 2,600 feet of new roads, for a total of 29.6 acres of surface disturbance.

Major cut and fill operations would not be necessary at TCH sites due to their limited size, the fact that they would not require construction of a large earthen sump, and their location on old log landings. At the end of the life span of the proposed action, TCH well

pads and associated access roads would be recontoured approximately to pre-project conditions.

To the greatest extent possible, the proposed deep exploration well pads have also been sited on relatively level sites. The creation of minor cut and fill slopes would be necessary at certain exploration well pads. Cut and fill would be balanced at each well pad, and would not significantly alter the topography of the area.

Roads would be limited to the narrowest width that would allow safe passage to the site and would be constructed as Class D single-lane resource roads, according to USFS specifications. Minor balanced cut and fill would be required for roads, but would not significantly alter the topography of the area. Specific details of proposed road construction would be submitted to the BLM, by CEGC Geothermal Sundry Notices (CEGC 1994).

At the end of the life span of the proposed action, the exploration well pads and associated access roads would either be recontoured to pre-project conditions (if a well is unproductive or if the geothermal resource proves to be not commercially viable) or left "as is" for further use (if the resource is commercially viable and CEGC decides to pursue development and utilization of the resource). An analysis of continued use of selected wells and access roads would be conducted as part of the environmental review for any future Plans of Development or Utilization submitted to the BLM and USFS.

Given the limited extent of proposed grading activities and the recontouring to pre-project conditions that would occur, the proposed action would not represent major changes to existing topography.

4.2.5. Unique Geologic Features

Wells 46-32, 18-32, 58-6, and 34-8TCH would be located near the Glass Mountain Lava Flow, as would the access road for well 46-32. This lava flow is considered to be a unique geological feature and is identified as a Geologic Special Interest Area by the USFS. Portions of the Glass Mountain Unit Area that include the Glass Mountain Lava Flow have no surface occupancy lease stipulations attached to geothermal leases. This stipulation prevents surface activities within the Glass Mountain Lava Flow. However, none of the components of the proposed action would occur within the designated no surface occupancy areas. In addition, none of the components of the proposed action would be located closer than 200 feet to the lava flow; this would be adequate to avoid affecting this unique geological feature.

4.2.6. Recovery of Mineral Resources

The only mineral extraction activities in the vicinity of the proposed action are several small rock quarries used by the USFS to supply road-building materials. There are no features of the proposed action that would occupy areas of known surface or subsurface mineral resources. The proposed action would therefore not prevent the recovery of any mineral resources.

4.2.7. Geothermal Resource

The proposed action would involve limited exploratory drilling and testing of the geothermal resource within the Glass Mountain KGRA. Geothermal fluids would only be removed from the resource during testing activities at the exploration wells. Given the limited extent and duration of proposed geothermal drilling and testing (30 to 90 days), the proposed action would not be expected to have a significant effect on or affect the life expectancy of the geothermal resource.

The proposed action would allow only exploratory drilling and testing, and would not include development or utilization of the geothermal resource. An analysis of effects to the geothermal resource from development and utilization would be considered speculative at this time. If CEGC decides in the future to pursue development and utilization of the resource, CEGC would submit the appropriate plans to the BLM and USFS. The effects of proposed development and utilization (construction and operation of a power plant) on the geothermal resource would then be subject to environmental review.

4.2.8. Well Blow-Out Hazards

Blow-outs are accidental, uncontrolled releases of geothermal fluids such as steam, gases, or hot water from a geothermal well during drilling operations. The potential effects of accidental releases of geothermal fluids include pollution of surface and shallow groundwater resources, hazards to workers' health and safety, and air contamination from emissions of gases such as hydrogen sulfide (see Section 4.6 for a discussion of potential effects to air quality from well blow-outs).

The risk of a blow-out during proposed drilling operations at the well pads would be considered low. The conditions that increase the potential for blow-outs to occur include:

- Drilling in incompetent rocks (soft, sedimentary rocks)
- Use of inadequate casing and cementing
- Use of inexperienced drillers

None of these conditions would occur with the proposed action. Drilling would be accomplished in the highly competent, volcanic rocks that have been demonstrated to exist in the vicinity and that are expected to be encountered at depth. In addition, the drilling program that would be implemented under the proposed POO includes required well control programs. These control programs include installation of blow-out prevention (BOP) equipment, periodic equipment testing, and safety drills. CEGC also proposes to use adequate casing and cementing, as well as experienced drilling personnel. These measures would minimize the potential for blow-outs.

In the highly unlikely event that a blow-out does occur, the effects to the environment would not be expected to be significant. In a TCH well, the small diameter of the well (2.5-inch inside diameter of the well bore) would prevent large quantities of fluids from escaping into the surrounding environment. Exploration wells are drilled with return of drilling mud, which greatly reduces the potential for blow-outs.

If a blow-out does occur, the majority of the geothermal fluid resulting from the blow-out would be expected to drain into the on-site sump, and CEGC would take immediate measures to control and correct the blow-out. Since the sumps would be constructed of impermeable materials, shallow groundwater resources would not be expected to be affected. Surface waters would also not be expected to be affected as all geothermal fluids would be expected to be contained at the site.

There is the potential that workers at the site of a potential blow-out could be harmed by the geothermal fluids or release of gases (particularly hydrogen sulfide). The Emergency Contingency Plan included as part of the POO includes measures that would reduce the potential for harm to employees from blow-outs, including the use of hydrogen sulfide monitors and alarms at each drilling rig. With the implementation of these safety precautions (and the low risk of well blow-outs), the risk to workers from well blow-outs would be considered low. Of the hundreds of geothermal wells in the United States, the Geothermal Resources Council has records for only seven blow-outs.

4.2.9. Geothermal Fluid Hazards

In the event of a blowout (discussed in 4.2.8. Well Blowout Hazards), workers could be exposed to geothermal fluids. The primary risk from geothermal fluids would be burns that could result contact with from either steam or hot fluid escaping from the well. Standard safety procedures for blowouts would limit this risk to a very low level. There is also the potential for workers to come in contact with geothermal fluids that are brought to the surface during the course of normal drilling and testing. Table 3.2-1 shows the constituent analysis for typical geothermal fluids from the Glass Mountain KGRA. The primary constituents are chloride compounds which, although somewhat corrosive to metals, are not considered hazardous to humans during skin contact.

Workers could also come in occasional contact with drilling muds during the drilling of the five deep exploration wells. All drilling fluids would be non-toxic, as defined by the EPA and Cal EPA, and hazardous wastes would not be produced. Although typical drilling muds are somewhat alkaline, brief skin contact with these muds is not considered to be hazardous to drill rig workers. See 4.3.2 in Section 4.3, Water Quality for a discussion of disposal of drilling fluids.

MITIGATION MEASURES

Although the proposed action would not result in significant adverse effects to unique geologic features or significantly increase the potential for erosion, the following mitigation measures are recommended to avoid adverse effects:

Mitigation Measure 4.2.1.

In order to protect the obsidian flow near pad 58-6, well pad facilities will be located 200 feet from the toe of the obsidian flow. No surface disturbance or activity will occur in the area between the edge of the pad and the toe of the obsidian flow.

Mitigation Measure 4.2.2.

Erosion controls (such as vegetated buffers and grass stabilization) will be used as prescribed by the USFS to protect surrounding undisturbed vegetation and down-slope areas. Erosion controls will stay in effect and be maintained until construction at the well pad site is completed or all of the cleared land at the well pad site is stabilized with new ground cover.

EFFECTS OF ALTERNATIVES B, C, AND D

Alternative B

The effects of Alternative B, elimination of pads 42-13TCH and 15-15TCH, would be similar to those of the proposed action (Alternative A). If Alternative B is selected, the potential for geologic hazards to affect people or facilities at those sites would be eliminated. There would be no potential for erosion at the two sites and the 0.28-acre area of the well pads would not be graded, reducing the alteration of topography in the area. With two fewer wells, there would be a lower potential for blow-out. If the two TCH wells are not drilled there would be less information obtained about the regional extent of the geothermal reservoir at this time. Mitigation Measures 4.2.1 and 4.2.2 would apply to this alternative.

Alternative C

The effects of Alternative C, elimination of pads 18-32 and 46-32, would be similar to those of the proposed action (Alternative A). If Alternative C is selected, the potential for geologic hazards to affect people or facilities at those sites would be eliminated. There would be no potential for erosion at the two sites and the 12-acre area required for the well pads and access road would not be graded, reducing the alteration of topography in the area. With two fewer wells, there would be a lower potential for blow-out. If the two exploration wells are not drilled there would be less information obtained about the regional extent and potential of the geothermal reservoir. Mitigation Measures 4.2.1 and 4.2.2 would apply to this alternative.

Alternative D

There would be no geologic effects from implementation of Alternative D, the no action alternative. Under this alternative, no additional knowledge would be gained about the geothermal reservoir character and extent. No mitigation would be required under this alternative.

4.3 Hydrology

SIGNIFICANCE CRITERIA

The proposed action would be considered to have a significant impact on the environment if it would:

- Substantially deplete or degrade groundwater resources
- Change the amount of surface water in any water body

- Contaminate a public water supply
- Substantially degrade water quality
- Interfere substantially with groundwater recharge
- Cause substantial flooding, or expose people or property to water-related hazards such as flooding

EFFECTS OF ALTERNATIVE A

4.3.1. Depletion of Water Resources

Water consumption would primarily occur during the drilling phase of the proposed action. CEGC currently proposes to obtain all water for well drilling and coring activities from the two existing wells in the Arnica Sink area. However, CEGC could obtain water for drilling at well 63-20TCH and 15-15TCH from existing wells such as Pumice Stone or Harris Springs located approximately five to six miles west of Little Mount Hoffman (see Figure 1.1-2) if required, due to their distance from the Arnica Sink wells. In addition, if any wells prove to be successful, produced fluids from these wells would be used where feasible to reduce the need for water from other sources (CEGC 1994).

Water would be needed primarily to create drilling mud, which is a mixture of water and clay. Drilling mud would be used to cool and lubricate the drill bit and to remove cuttings from the well hole. Proposed TCH drilling would require approximately 3,000 to 5,000 gallons of water per day. Exploratory wells would require approximately 9,000 gallons per day and up to 40,000 gallons could be required in lost circulation zones.

Each TCH would take from 25 to 60 days to drill, and each exploration well would take 60 to 90 days to drill. Proposed geothermal drilling would take place over several years, and water use would be spread out over time. Geothermal drilling would therefore not significantly deplete water resources in the vicinity. No water would be withdrawn from Medicine Lake.

Water could also be used during grading of roads or drill pad sites if needed to suppress dust (CEGC 1994). Water would be trucked to the construction locations from the water wells near the Arnica Sink. The quantity of water needed for dust suppression would be relatively small compared to the amount of water used for drilling activities, and would be used for a very short time (one to two days for each TCH well, and about two weeks for each exploration well). Water use for dust control would therefore not significantly deplete water resources in the vicinity, including Medicine Lake.

Proposed activities would not affect the water levels in Medicine Lake because the wells would be cased and cemented and only geothermal fluids from the deeper geothermal reservoir below 3,000 feet deep would be withdrawn from the exploration wells. Implementation of the USGS hydrologic monitoring plan for the Glass Mountain area (USGS 1994) would provide a mechanism for monitoring lake levels and spring discharge.

4.3.2. Water Quality

The five deep exploration well pads would require construction of sumps with a capacity of approximately 1,000,000 gallons. The sumps at the these well pads would be adequately sized to contain the anticipated volumes of drilling muds and fluids produced during testing. All drilling fluids would be formulated to be non-toxic, as defined by the EPA.

During drilling at the exploration well pads, water, mud, and drill cuttings would be discharged to the sump; if the solids separation process is used, geothermal fluids would be discharged to the sump, and de-watered drill cuttings and other solids would be stored in containment pits in other containers on the drill pad sites. Sumps would be lined with clay to a permeability of 10^{-6} cm/sec to avoid the potential for percolation of drilling or produced fluids to affect any shallow groundwater. At least two feet of freeboard would be maintained in sumps to minimize the risk of overflows. Water would be recirculated from the sump to the drilling mud systems as a conservation measure. Heavy rains could result in the need to truck excess water that collects in the sump to an approved dumpsite or inject the water into an injection well. After completion of the well, the sump contents would be solar dried if possible, mixed with native soils, and buried in the sump, or hauled by truck to an approved dump site.

TCH wells would not produce geothermal fluids; sumps would therefore not be required at the TCH well pads. These well pads would include a reserve pit to provide for emergency storage of any leaked drilling fluids. The 10 foot by 25 foot reserve pit would be constructed within the footprint of the well pad, and would be lined with plastic to prevent percolation of any fluids that might be contained in the reserve pit. Lining of the pit would ensure that groundwater quality would not be affected.

As discussed in Chapter 1, Introduction, the discharge of drilling and/or geothermal fluids to the well pad sumps would be regulated under a permit issued by the Central Valley Regional Water Quality Control Board, and would be accomplished in accordance with the GROs, stipulations of the BLM and USFS, and all applicable permits and regulations.

Surface Water: Surface water quality could potentially be affected if runoff, drilling fluids, or geothermal fluids were allowed to enter surface drainage systems in the vicinity of the proposed action. However, this would not occur due to the design features incorporated into the proposed action. Pads would be prepared to drain internally to prevent any accidental spills from leaving the drill pad. Should they occur, accidental spills would be managed as set forth in the CEGC Emergency Contingency Plans. Additionally, none of the proposed well sites are located near surface water. The surface water closest to a proposed well pad is Paynes Springs, which is approximately 0.4 miles southeast of well pad 56-18.

In addition to the design features that would prevent surface water contamination, the proposed action would not affect the water quality of Medicine Lake due to the distance of the drill pads from the lake and the fact that many of the well pads are located in basins

that drain away from Medicine Lake. The drill pad that would be closest to the lake is pad 42-13TCH, which is 0.7 miles from the east end of Medicine Lake. Implementation of the USGS hydrologic monitoring plan for the Glass Mountain area (USGS 1994) would provide for monitoring water quality at the lake and other surface waters in the area.

Road construction and construction of TCH well pads could result in a negligible increase in runoff that would be absorbed in non-disturbed areas. The limited new road construction and associated improvements would incorporate standard drainage improvements and BMPs required by USFS. The limited amount of increased runoff from road and TCH pad construction would not significantly affect surface water quality.

Groundwater: Groundwater quality could be adversely affected if drilling fluids or geothermal fluids were allowed to enter subsurface aquifer formations or if contaminated runoff were allowed to infiltrate the groundwater system in recharge zones. However, the fluids produced during well drilling and testing would not reach groundwater aquifers due to the design features incorporated into the proposed action. Implementation of the USGS hydrologic monitoring plan for the Glass Mountain area (USGS 1994) would provide a mechanism for monitoring groundwater quality in the area.

The proposed exploration wells and TCH wells could pass through a number of aquifers during the drilling phase. If not properly drilled and cased, drilling fluids and geothermal fluids could enter shallow aquifer systems, or water could move through the well bore from one aquifer to another. However, the proposed exploration and TCH wells would be cased and cemented in accordance with the GROs to prevent geothermal fluids from entering shallow groundwater zones. Standard casing procedures are highly effective in preventing aquifer contamination. Adverse effects to groundwater are therefore not expected.

Construction of the five exploration well pads would result in compaction and grading of soils at the pads and would divert precipitation into the sumps or drainage areas instead of allowing it to infiltrate. Given the small area occupied by each pad (about five acres), the proposed action would not significantly affect groundwater discharge in the vicinity.

Paynes Springs is located approximately 0.4 miles southwest of well 56-18. There is the concern that drilling at well 56-18 could affect water quality at Paynes Springs by introducing muds into the groundwater aquifer that feeds the spring area. Any effect that could occur would be expected to occur during the shallowest drilling at well 56-18, due to the elevations of the well pad and the spring area. However, this is unlikely for several reasons. The first 350 feet of drilling would occur rapidly, usually within one to two days. Shallow aquifer zones would then be cased before drilling into deeper formations to prevent any contamination of these aquifers by drilling muds, water from other aquifers, or geothermal fluids. Additionally, drilling muds used during shallow drilling are generally composed almost entirely of water, with small amounts of bentonite (a natural clay material). Any minor amounts of drilling mud that would enter the aquifer would be diluted in the groundwater and would not exist at sufficient concentrations to adversely affect the water by the time it migrates the 0.5 mile distance to Paynes Springs. The

potential for the proposed action to adversely affect Paynes Springs is therefore considered unlikely.

4.3.3. Loss of Drilling Fluids

CEGC would use two different methods to drill the TCH wells and the exploration wells that are proposed under the POO (see Section 2.1). For the TCH wells, CEGC would drill the wells by allowing the drill bit to advance without maintaining circulation of drilling fluid from the drill bit back to the surface. For the exploration wells, CEGC would attempt to maintain pressure so that the drill cuttings are floated to the surface by the drilling fluids. Under both drilling methods, there is the potential that drilling fluids could flow into subsurface porous rock formations and/or aquifers (known as "lost circulation"). However, the TCH and exploration well drilling fluids would not significantly affect groundwater or surface water resources in the area. A discussion of each drilling method and why it would not affect hydrology in the area follows.

TCH Well Drilling: The drilling of TCH wells would require the use of drilling fluids (i.e., water and non-toxic muds and additives) primarily to lubricate the drill bit as it passes through subsurface rock formations. The drilling method used to drill a TCH well under the proposed POO would be similar to the drilling method that is typically used to drill a water well. Only the first 550 feet of the 5,500 TCH wells would be cement cased; the remaining depth of the well would be drilled using standard diamond drilling equipment with no casing (see Section 2.1).

When drilling a TCH well, drilling fluids would be applied as the drill bit advances, and the drill bit (which has a hole in its center) would form a cylindrical rock core. Every 10 to 15 feet, a core barrel would be sent down the core hole to retrieve the rock core and bring the core to the surface. By coring the rock, the majority of the rock material would be mechanically removed intact through the core recovery. Rock material that would not be retrieved would be ground into minute particles by the drill bit as it advances.

Since TCH wells would be drilled without maintaining circulation of drilling fluid from the drill bit back to the surface, drilling fluids and ground rock could flow into any porous subsurface formations or aquifers that are encountered during drilling. However, the areal extent of any drilling fluid or ground rock migration would be limited due to the nature of the subsurface formations and the temporary and minor use of the drilling fluids. In addition, only non-toxic drilling fluids would be used in drilling TCH wells; the fluids would therefore not substantially degrade or adversely affect any local aquifers that could be encountered during drilling. Experience at other geothermal drill sites has indicated that temporary and minor release of drilling fluids in subsurface formations does not pose a significant threat to underground aquifers. The drilling of TCH wells would therefore not be expected to adversely affect the hydrologic system in the vicinity of the proposed TCH drill sites.

Exploration Well Drilling: The drilling of exploration wells would require the use of drilling fluids to lubricate the drill bit as it passes through subsurface rock formations. In

addition, drilling fluids for these wells would be used to float drill cuttings to the surface, where the cuttings would be separated from the drilling fluids and stored until disposal (drilling fluids would be recirculated to the drilling operation). Circulation of the drilling fluids would therefore need to be maintained in the well bore during exploration well drilling, and CEGC would attempt to minimize lost circulation. Exploration wells would be drilled to a depth of approximately 9,000 feet, with cement casings and a production liner used to maintain pressure and prevent the flow of drilling fluids into any porous subsurface formations or aquifers that are encountered during drilling (see Section 2.1).

During exploration well drilling, there is the potential for lost circulation in certain types of subsurface formations (such as porous or fractured volcanic rock) during the brief period during drilling through the formation and before the well can be cased or lined. However, the potential flow of drilling fluids during drilling would be temporary and minor, and the nature of the subsurface formations would limit the areal extent of any drilling fluid migration. Since only non-toxic drilling fluids would be used in drilling exploration wells, drilling fluids would not substantially degrade or adversely affect any local aquifers that could be encountered during drilling. As noted above, experience at other geothermal drill sites has indicated that temporary and minor release of drilling fluids in subsurface formations does not pose a significant threat to underground aquifers.

If there is severe lost circulation during exploration well drilling, CEGC could use one of two methods to temporarily regain circulation until the well can be cased or lined:

- *Lost Circulation Material (LCM):* LCM is material that is pumped downhole to seal openings in the subsurface formation. Commonly approved materials include cottonseed hulls, cellulose insulation, wood chips, sawdust, and bentonite chips. This technique is only rarely employed in drilling because it tends to clog up the drill pipe and bit ports and to restrict the flow of drilling fluid.
- *Air, Foam, or Aerated Mud:* These drilling techniques involve the use of air, foam, or aerated mud instead of or in addition to the normal drilling fluid to combat lost circulation. These enhance the circulation properties of the medium and reduce pressure downhole. In practice, air, foam, or aerated mud have been shown to be limited in their effectiveness.

Use of either of these temporary measures during severe lost circulation would ensure that pressure is regained and that no significant flow of drilling fluids into subsurface formations or aquifers occurs. After the exploration wells are cased and lined, there would be no potential for the drilling fluids to affect groundwater aquifers in the area. The drilling of exploration wells would therefore not be expected to adversely affect the hydrologic system in the vicinity of the proposed exploration drill sites.

MITIGATION MEASURES

Mitigation Measure 4.3.1

In order to verify that no effects are occurring at Paynes Springs from implementation of wells at well pads 56-18 and 13-18, CEGC will collect water samples from the springs before drilling, during initial drilling, after drilling to 500 feet (the equivalent elevation to the springs), and after completion of these wells. If effects are identified after analysis of

the samples, drilling at these wells will be halted until the hydrologic connection to the springs is better understood. BLM and the USFS will compare the samples after they are analyzed.

EFFECTS OF ALTERNATIVES B, C, AND D

Alternative B

The effects of Alternative B, elimination of pads 42-13TCH and 15-15TCH, would be similar to those of the proposed action (Alternative A). If Alternative B is selected, less water would be used during the drilling process, and the potential for depletion of water resources would still be less than significant. The potential for effects to surface water quality would be essentially the same as Alternative A. Development of these two TCH well pads under Alternative A would not be expected to have any effects on water supply or quality at Medicine Lake. Elimination of the two well pads under this alternative would therefore not result in any reduction in potential effects to Medicine Lake. Elimination of the two wells under this alternative would also not result in a decreased potential for effects to groundwater quality. With two fewer wells, the potential for loss of drilling fluids during lost circulation episodes at the two sites would be eliminated. Mitigation Measure 4.3.1 would apply to this alternative.

Alternative C

The effects of Alternative C, elimination of pads 18-32 and 46-32, would be similar to those of the proposed action (Alternative A). If Alternative C is selected, the potential for effects to surface water quality would be slightly less than Alternative A due to elimination of grading at two well pads and one access road. Elimination of the two wells under this alternative would result in a slightly decreased potential for effects to groundwater quality than Alternative A. With two fewer wells, there would be a lower potential for loss of drilling fluids during lost circulation episodes. Mitigation Measure 4.3.1 would apply to this alternative.

Alternative D

There would be no hydrologic effects from implementation of Alternative D. Mitigation would not be required under this alternative.

4.4 Cultural Resources

SIGNIFICANCE CRITERIA

Federal law requires the consideration of effects to historical and cultural resources prior to authorizing any activity, while state law requires the protection of historical and cultural resources. A proposed action would be considered to have a significant effect on cultural resources if it would adversely affect a resource that is listed or has been determined to be eligible for listing on the National Register of Historic Places (NRHP).

At the state level, the CEQA Guidelines provides the framework for evaluating potential impacts of a proposed action on cultural resources. Pursuant to Section 15065(a) of the CEQA Guidelines, the elimination of "important examples of the major periods of California history or prehistory" would be a significant impact on the environment. Appendix G of the CEQA Guidelines states that a project will normally have a significant effect on the environment if it will "disrupt or adversely affect a prehistoric or historic archaeological site or a property of historic or cultural significance to a community or ethnic or social group." Appendix K of the CEQA Guidelines states that a significant negative impact on the environment would be caused by the disruption or destruction of an "important archaeological resource," which is defined as a resource that:

- Is associated with an event or person of recognized significance in California or American history, or recognized scientific importance in prehistory
- Can provide information which is both of demonstrable public interest and useful in addressing scientifically consequential questions
- Has a special quality such as oldest, best example, largest or last surviving example of its kind
- Is at least 100 years old and possesses substantial stratigraphic integrity
- Involves important research questions that historical research has shown can be answered only with archaeological methods

In addition, a proposed action would be considered to have a significant effect if it would significantly interfere with or disrupt Native American uses of an area.

EFFECTS OF ALTERNATIVE A

4.4.1. Prehistoric Resources

Survey and excavations have produced few chronologically sensitive prehistoric artifacts in the Medicine Lake Highlands. No prehistoric sites nor isolated prehistoric finds were discovered at the TCH or exploration well pad locations or associated access roads, and no NRHP-eligible or listed sites have been identified in the immediate vicinity of the proposed action. The proposed action would therefore not affect prehistoric resources.

4.4.2. Historic Resources

No historic sites nor isolated historic finds of significance were discovered at the TCH or exploration well pad locations or associated access roads. No NRHP-eligible or listed historic sites have been identified in the immediate vicinity of the proposed action. The proposed action would therefore not affect historic resources.

4.4.3. Native American Concerns

The Medicine Lake area is used by several Native American groups, primarily for spiritual and cultural heritage purposes. No Native American uses have been identified in areas that would be directly affected by implementation of the proposed POO; the proposed action would therefore not be expected to have a direct effect on Native American uses within the Medicine Lake Highlands.

Implementation of the proposed POO would result in a relatively small amount (approximately 29.6 acres) of dispersed surface disturbance, and activities would have a short-term duration (30 to 90 days for drilling at each pad, and about 90 days for testing at the exploration pads). The proposed POO would not be highly visible to Native American groups during Native American use of the Medicine Lake area (see Section 4.8, Visual Resources). The noise levels generated by the project would be temporary in nature and sufficiently low so as to not result in significant noise effects (see Section 4.7, Noise). Based on these factors, the proposed action would not be expected to significantly interfere with Native American use of the area and would not represent a significant effect on Native American groups.

The issues of concern raised by Native American groups during the scoping and consultation process are described in Section 3.4 of this document. These issues are addressed throughout Chapter 4 in the appropriate parameter discussion (e.g., concern about visual effects are addressed in Section 4.8, Visual Resources). No significant effects related to these issues are expected to occur.

Although Native American groups have expressed concern over how future utilization and development of the geothermal resource could affect their use of the area, such an analysis is beyond the scope of this document. This EA/IS addresses the effects of the proposed POO. If a commercially viable geothermal resource is discovered within the Glass Mountain KGRA as a result of the proposed POO, utilization and development of the geothermal resource could occur. However, this utilization and development would require the preparation of separate Plans of Development and Utilization. These future plans (if warranted) would describe any detailed plans for construction and operation of geothermal facilities. Similar to the POO, these plans would be subject to environmental review and public comment. The environmental review for these plans would address the effect of these plans on Native American groups.

MITIGATION MEASURES

Although the proposed action is not expected to result in significant adverse effects to cultural resources, the following mitigation measures are recommended to avoid adverse effects:

Mitigation Measure 4.4.1.

If archaeological resources are discovered during excavation for the proposed action, all work in the immediate vicinity will be suspended pending site investigation by the USFS and a qualified archaeologist to assess the materials and determine their significance. If the qualified professional determines that the resource will yield new information or important verification of previous findings, construction in the immediate area will not resume until the USFS and SHPO have been consulted and the resources appropriately evaluated and treated.

Mitigation Measure 4.4.2.

If prehistoric archaeological deposits that include human remains are discovered by the project sponsor or any construction contractors during excavation for the proposed action, the County Coroner will be immediately notified. If the remains are found to be Native American, local Native American groups and the Native American Heritage Commission (NAHC) will be notified within 24 hours. The most likely descendants of the deceased Native American will be notified and given the chance to make recommendations for the remains. If no recommendations are made within 24 hours, remains may be reinterred elsewhere on the property. If recommendations are made and not accepted, the NAHC will mediate the problem.

Mitigation Measure 4.4.3.

If archaeological resources are discovered during excavation for the proposed action and avoidance of these resources is not feasible, evaluation of the resources will be required. An evaluation plan will be prepared that provides for the methodical excavation of resources that would be adversely affected. Only a qualified archaeologist or cultural resources consultant will be allowed to collect any discovered prehistoric resources. The work will be accomplished within the context of a detailed research design and in accordance with current professional standards. The plan will result in the extraction of sufficient volumes of non-redundant archaeological data so as to address important regional research consideration, and detailed technical reports will be prepared to document the findings.

EFFECTS OF ALTERNATIVES B, C, AND D

Alternative B

Similar to Alternative A, implementation of Alternative B would not affect prehistoric or historic resources or Native American use of the area. Mitigation Measures 4.4.1 through 4.4.3 would apply to this alternative.

Alternative C

Similar to Alternative A, implementation of Alternative C would not affect prehistoric or historic resources or Native American use of the area. Mitigation Measures 4.4.1 through 4.4.3 would apply to this alternative.

Alternative D

Implementation of Alternative D would not affect prehistoric or historic resources or Native American use of the area. Mitigation would not be required under this alternative.

4.5 Biology

SIGNIFICANCE CRITERIA

Federal and state endangered species laws require protection of listed endangered or threatened plants and animals. If the proposed action would affect the range of or

eliminate an endangered or threatened plant or animal species, or would result in take of endangered or threatened animal species, this would be considered a significant effect.

The USFS has established a list of 37 Management Indicator Species (MIS) (see Table 3.5-2). If the proposed action would significantly affect the range, result in significant take, or eliminate any of these animal species, this would be considered a significant effect.

Section 15065(a) of the CEQA Guidelines specifies that a lead agency shall find that a project may have a significant effect on the environment when the project has the potential to substantially reduce the habitat of a fish or wildlife species, threaten to eliminate a plant or animal community, or reduce the number or restrict the range of a rare or endangered species. Appendix G of the CEQA Guidelines states that a project would normally have a significant effect on the environment if it would substantially affect a rare or endangered species or the habitat of the species or would substantially diminish habitat for fish, wildlife, or plants. In addition, the Guidelines provide that plant and animal species may be treated as "rare or endangered" even if not on one of the official lists if:

- The survival and reproduction of the species in the wild are in immediate jeopardy
- The species exists in such small numbers throughout all or a significant portion of its range that it may become endangered if its environment worsens
- The species is likely to become endangered in the foreseeable future and may be categorized as "threatened" under Federal law

VEGETATION EFFECTS OF ALTERNATIVE A

4.5.1. Loss of Vegetation

The proposed action would require the clearing of existing vegetation from the well pads and access road corridors. Vegetation at the well pads and in the access roads consists primarily of trees of various ages and sizes, as described in Section 3.5. Lodgepole pine and red fir are the two main conifer types that are found at the well pads and in the access roads. With the exception of well 46-32 and a portion of well pad 18-32, the proposed facilities have been sited at least partially on existing roads or in areas that have been subject to logging activities or other surface disturbances in the past. This would minimize the effect of the proposed action on existing vegetation. Table 4.5-1 summarizes the removal of trees and snags that would occur at each well pad and access road.

Total surface disturbance at the 10 proposed well pads and within the 2,600 feet of new access road would be approximately 29.6 acres. The well pad dimensions (approximately 60 feet by 100 feet for TCH wells, and 400 feet by 600 feet for exploration wells) are designed to allow the required drilling facilities at each well pad site. Improvements to about 8,150 linear feet of existing access road would be required. In some areas, only scattered trees would need to be removed to widen the existing road. In other areas, vegetation (primarily lodgepole pine) that has begun to re-emerge in the access road corridor would need to be cleared to allow vehicle access to the well pad sites.

Table 4.5-1: Tree and Snag Removal at Well Pad Sites and Access Roads

Well Pad	Estimated Trees to be Removed	Estimated Snags to be Removed
34-8TCH	*Well pad:* seedling and saplings *Access road:* seedling and saplings	*Well pad:* None *Access road:* None
42-13TCH	*Well pad:* seedling and saplings; 5 trees less than 8-inch dbh[1] *Access road:* seedling and saplings	*Well pad:* one 10-inch dbh snag *Access road:* None
11-24TCH	*Well pad:* seedling and saplings *Access road:* seedling and saplings	*Well pad:* none *Access road:* none
15-15TCH	*Well pad:* none *Access road:* none	*Well pad:* none *Access road:* none
63-20TCH	*Well pad:* none *Access road:* none	*Well pad:* none *Access road:* none
18-32	*Well pad:* 10 trees greater than 24-inch dbh; 40 to 60 trees with 15-inch to 24-inch dbh; remaining trees less than 10-inch dbh *Access road:* 80 6-inch to 22-inch dbh trees	*Well pad:* 14 10-inch to 30-inch dbh snags; one 38-inch dbh snag *Access road:* 4 snags greater than 6-inch dbh
46-32	*Well pad:* numerous trees less than 20-inch dbh; two trees greater than 20-inch dbh *Access road:* seedling and saplings	*Well pad:* 17 snags greater than 6-inch dbh *Access road:* one 10-inch dbh snag
58-6	*Well pad:* 150 to 180 trees greater than 15-inch dbh; 600 to 750 trees with 6-inch to 15-inch dbh; remaining trees less than 6-inch dbh *Access road:* 50 6-inch to 12-inch dbh trees	*Well pad:* 3 snags greater than 6-inch dbh *Access road:* none
56-18	*Well pad:* 50 to 60 trees greater than 20-inch dbh; 450 trees with 8-inch to 20-inch dbh; remaining trees less than 8-inch dbh *Access road:* seedling and saplings	*Well pad:* 8 to 10 snags greater than 6-inch dbh *Access road:* none
13-18	*Well pad:* 500 trees greater than 8-inch dbh *Access road:* none	*Well pad:* two to three snags greater than 6-inch dbh *Access road:* none

Notes:

[1]dbh = diameter at breast height

SOURCE: Wildlife Dynamics 1994

All necessary timber removal at the well pads and access road corridors would be conducted in accordance with USFS specifications. In accordance with USFS requests, CEGC would avoid conifer species over 14 inches dbh where feasible. It is expected that commercial timber (i.e., timber with at least a 4-inch dbh on the short end and over 20 feet long) would be limbed and decked for later removal and sale. Brush, removed tree limbs, and other vegetation at the well pads and access road corridors would be scattered in surrounding areas, piled and burned at the well pads, or buried as appropriate at locations designated by the USFS. Tree stumps would be disposed of at a USFS-designated site and would not be buried at the well pad sites.

At the end of the life span of the proposed action, all TCH well pads and associated access roads would be restored to pre-project conditions to the greatest extent possible. TCH well pads would be recontoured to approximately their pre-project contours. Revegetation of the TCH well pads would be expected to occur naturally and relatively rapidly since the TCH pads would receive minimal surface disturbance and soil compaction. More effort would be required to restore TCH access roads to natural conditions. These facilities would be recontoured, scarified to loosen the top soil, and reseeded and planted as necessary with native vegetation.

The fate of the exploration well pads at the end of the life span of the proposed action is unknown at this time. If the geothermal resource proves to be not commercially viable, all of the exploration well pads and associated access roads would be reclaimed in a manner similar to the TCH access roads.

If the proposed geothermal exploration program is successful and the geothermal resource proves to be commercially viable, CEGC would need to decide at that time whether or not to pursue development and utilization of the resource. If development and utilization is not undertaken, the exploration well pads and access roads would be reclaimed in a manner similar to the TCH access roads. If development and utilization is undertaken, CEGC would submit the appropriate Plans of Development and Utilization to the BLM and USFS. These plans would identify which wells could be abandoned (and thus reclaimed), which wells would be used for production wells, and which wells would be used as injection wells. The environmental effects of continued operation of selected wells (including vegetation effects) would be assessed as part of the environmental review for any proposed Plan of Development or Utilization.

Given the limited acreage of vegetation that would be cleared for the well pads and access road corridors, the fact that 9 of the 10 proposed well pads would be at least partially located on previously logged or cleared areas, and the reclamation that would occur at these facilities, the proposed action would not significantly affect vegetation on the Modoc or Shasta-Trinity National Forests.

4.5.2. Special Status Species

No special status plant species have been identified or are known to occur at any of the proposed well pads or the areas of road construction or improvement. The proposed

action would not affect the two special status plant species (talus collomia and northern daisy) known to occur in the vicinity since suitable habitat for these species does not exist at the well pad sites or access road corridors. The proposed action would therefore not affect any special status plant species.

4.5.3. Old Growth Forest

Although most forest habitats in the vicinity of the proposed action have been previously harvested, there are stands of old growth forest dispersed throughout the vicinity. In addition, trees that are of sufficient size and maturity to be considered old growth timber are scattered throughout the vicinity, both in areas that have not been harvested and in areas that have been selectively harvested.

The proposed well pads and access roads would not be located in timber stands that could be considered pure old growth forest; however, certain pads and roads would be located in areas that contain old growth trees. Well pads 46-32 and 18-32, as well as the access road to well pad 46-32, would be located in a previously unharvested area that contains old growth trees. In addition, there are old growth trees located on the uncleared portions of well pads 58-6 and 56-18, which are in areas that have been subject to previous timber harvest. Implementation of the proposed action would require the removal of vegetation (including old growth trees) from these well pads and the access road to well pad 46-32.

The removal of old growth trees from well pads 46-32, 18-32, 58-6, and 56-18 and the access road to well pad 46-32 would not be expected to adversely affect the integrity of the old growth forest in the project vicinity. A total of approximately 23 acres (not all of which contains old growth trees) would be cleared for these well pads and the access road. This affected acreage would represent an extremely small portion of the total forest that contains either old growth stands or scattered old growth trees. In addition, all of these well pads and the access road would be located near existing areas that have either been previously harvested, cleared, or otherwise disturbed.

The potential environmental consequences on wildlife from clearing old growth trees from well pads 46-32, 18-32, 58-6, and 56-18 and the access road to well pad 46-32 are discussed in this section under "Wildlife Effects."

4.5.4. Deposition of Geothermal Fluids on Vegetation

Well testing could result in the release of minor amounts of geothermal fluids to the atmosphere. Deposition of these fluids on the surrounding vegetation downwind of the testing well could occur. Fluids with elevated levels of boron and/or bicarbonate could cause minor, temporary injury to the vegetation upon which it lands.

Extensive monitoring of effects to vegetation from exposure to geothermal fluids from operation of geothermal power plants has been conducted at The Geysers and Coso geothermal fields. Monitoring at The Geysers has indicated that although some injury to vegetation from boron did occur, no long-term vegetation injury could be attributable to

drift from geothermal power plants at The Geysers. At Coso, no adverse effects to vegetation were observed from geothermal operations (USFS et al. 1994).

The proposed action would not be expected to have an adverse effect on vegetation from the deposition of geothermal fluids. In comparison to the power plant operations at The Geysers and Coso geothermal fields, the proposed action would involve only short-term exploration and testing of a geothermal resource. The magnitude of potential releases of geothermal fluids from the proposed action would be significantly less than those that occur from the power plants at The Geysers and Coso. In addition, control measures have been included as part of the proposed POO to prevent the release of geothermal fluids to the atmosphere. Deposition of significant amounts of fluids on surrounding vegetation would therefore not occur.

MITIGATION MEASURES

Although the proposed action would not be expected to result in significant adverse effects to vegetation, the following mitigation measure is recommended to reduce potential effects to vegetation during construction and operation activities of the proposed action.

Mitigation Measure 4.5.1.

Conifers over 14 inches dbh will be avoided where feasible during pad construction. In addition, implementation of Mitigation Measure 4.2.2 will ensure that there would be no erosion effects to vegetation.

VEGETATION EFFECTS OF ALTERNATIVES B, C, AND D

Alternative B

The overall potential for effects to vegetation if Alternative B is implemented would be reduced compared to Alternative A due to the elimination of well pads 42-13TCH and 15-15TCH. There would be about 0.28 acres less area cleared for well pads under this alternative. As with Alternative A, there would be no effects to special status plant species under this alternative. Since the two pads that would be eliminated do not have old growth trees, this alternative would not reduce potential effects to old growth forests. Since the two wells that would be eliminated under Alternative B are TCH wells which do not vent geothermal steam or fluids during testing, there would be no reduction in the potential for effects to vegetation due to deposition of geothermal fluids. Mitigation measure 4.5.1. would apply to this alternative.

Alternative C

The overall potential for effects to vegetation if Alternative C is implemented would be reduced compared to Alternative A due to the elimination of well pads 46-32 and 18-32 and the access road to well pad 46-32. There would be about 12 acres less area cleared for well pads and access roads under this alternative. As with Alternative A, there would be no effects to special status plant species. Since the two pads that would be eliminated do

have old growth trees, this alternative would reduce effects to old growth trees. Elimination of two exploration wells under Alternative C would slightly reduce the potential for effects to vegetation due to deposition of geothermal fluids during the testing period. Mitigation measure 4.5.1. would apply to this alternative.

Alternative D

There would be no effects to vegetation from implementation of Alternative D, and no mitigation would be required.

WILDLIFE EFFECTS OF ALTERNATIVE A

4.5.5. Wildlife Habitat

Development of the well pad sites and the new access roads would result in the loss of up to 29.6 acres of wildlife habitat. In addition, about 8,150 linear feet of existing access road would require improvement. Improvements would range from minor widening of well-established roads to vegetation clearance within road corridors that have re-emergent vegetation.

Given the limited acreage that would be disturbed by the proposed action and the large area of wildlife habitat that exists in the vicinity of the proposed action, habitat removal at the well pads and access roads would not be expected to have an adverse effect on general wildlife habitat. Since well pads and access roads are generally located on or in the proximity of previously disturbed areas and in areas that are currently used for dispersed recreational uses (with the associated human presence), these pads and roads are considered to be of relatively low habitat value to general wildlife species in comparison to nearby lesser-disturbed areas in the Modoc National Forest.

No new roads are proposed for areas that are critical to animal migration, and the new roads that would be developed would not be expected to serve as an insurmountable barrier to any animal movements. At the end of the life span of the proposed action, reclamation of appropriate well pads and access roads would return disturbed areas to use as wildlife habitat.

During project construction, drilling, and well testing, some animals may avoid habitats in the vicinity of the proposed action due to the presence of humans and increased noise levels (for a discussion of noise effects on animal species, see 4.7.5 in Section 4.7, Noise). However, since proposed activities would be sporadic and temporary in nature, any avoidance of habitats in the vicinity of the proposed action by general wildlife species would also be temporary. In addition, lighting for drilling facilities would be placed so as to not shine directly into surrounding habitats in order to minimize any disturbance of wildlife in the area.

CEGC would construct fences along the perimeter of the well pads, which would minimize the potential for wildlife to pass through the well pad sites and potentially be injured or affected by on-site activities. The material for this fencing would be a flexible

plastic, and would be a visually non-obtrusive color such as green or brown. The fencing would also prevent animals such as deer from drinking from the sumps at the exploration pads. Although sump contents would not be non-hazardous, it would be necessary to prevent animals from drinking from the sumps since the presence of animals on the well sites would increase the potential for injury to these animals.

4.5.6. Northern Spotted Owl

Well pads 18-32 and 46-32 (and the access road to pad 46-32) contain suitable habitat for the northern spotted owl. In addition, suitable habitat for the owl exists throughout the vicinity of the proposed action. However, no owls were observed during the habitat assessment for the proposed action (Wildlife Dynamics 1994). In addition, no northern spotted owls were observed during other recent surveys in the vicinity of the proposed action, and the project vicinity does not appear to be occupied by spotted owls on a regular basis (Gutiérrez 1993; Galea 1994).

Although construction of well pads 18-32 and 46-32 and the access road to pad 46-32 would eliminate the trees at these sites from use as potential habitat for the northern spotted owl, this tree removal would not be expected to adversely affect this species. The total acreage affected by development of these sites would be an extremely small portion of the existing suitable habitat for the owl. There are no known owl breeding pairs or populations that use these sites, and there are no known owl home ranges that include these well pads and access roads. Implementation of the POO would therefore not affect any owl breeding pairs or populations. The well pads and access road contain old growth trees, but are not pure old growth stands. Since the northern spotted owl prefers old growth stands, the development of the pads and road would not affect the preferred habitat of the owl.

Although there are indications that no owls exist within the vicinity of the proposed action, the survey protocol for northern spotted owl requires that six visits be made over a 2-year period, with three visits per year. To date, only the first year of surveys for northern spotted owl have been completed (Galea 1994). The first-year survey included all of the proposed well pad and access road locations except for pad sites 63-20TCH and 15-15TCH (see Figure 1.1-2). The second year of surveys to fulfill protocol requirements for all pads and access roads except 63-20TCH and 15-15TCH will be completed during May 1995 (Ratcliff 1995; Galea 1995).

4.5.7. Northern Goshawk

Well pad 42-13TCH and all of the exploration well pads contain at least marginally suitable habitat for the northern goshawk. No goshawks were observed during the habitat assessment for the proposed action (Wildlife Dynamics 1994). Goshawks have been observed during other recent surveys in the vicinity of the proposed action (not at the well pads or access roads), but these goshawks appeared to just be passing through the vicinity; goshawks are not known to nest in the vicinity (Galea 1994).

Implementation of the proposed POO would reduce the amount of available habitat for the northern goshawk; however, the species would not be expected to be adversely affected by the proposed action due to the limited amount of disturbance. Since there are no known nests or breeding pairs in the vicinity, development of the well pads and associated roads would not be expected to affect the nesting of this species. The relatively small acreage of habitat that would be affected by development of these sites would be an extremely small portion of the existing habitat for the goshawk. The old growth trees that exist at some of the well pad sites are not pure old growth stands that would be considered preferred habitat for the goshawk.

Since goshawk move their nesting sites from year to year, surveys are generally valid only for the year in which they are conducted, and two consecutive years of surveys are recommended to confirm non-occupancy. The 1994 goshawk survey (Galea 1994) included all of the proposed well pad and access road locations except for pad sites 63-20TCH and 15-15TCH (see Figure 1.1-2); the results of the 1994 survey indicate that the surveyed area is not occupied by goshawk. In order to confirm these results and ensure no nests have been established within the project area, a goshawk survey is necessary during the 1995 nesting period (March 1 through July 15) for all pads and access roads except 63-20TCH and 15-15TCH. Goshawk protocol requires a second survey during the post-fledgling dependency period (early July through late August). However, if no nests are found and no responses are recorded during the nesting period survey, a second survey is not necessary (Ratcliff 1995). Completion of these surveys would fulfill goshawk protocol requirements for all pads and access roads except 63-20TCH and 15-15TCH.

4.5.8. Pileated and Other Woodpeckers

No woodpeckers were observed at any of the well pads or access roads during the habitat assessment for the proposed action (Wildlife Dynamics 1994). Well pads 18-32, 46-32, 56-18, and 42-13TCH provide at least marginally suitable habitat for the pileated woodpecker and other woodpeckers. The relatively small acreage of habitat that would be affected by development of these sites would be an extremely small portion of the existing woodpecker habitat. In addition, the well pads and access roads are not known to be regularly inhabited by woodpeckers. The species would therefore not be expected to be adversely affected by the proposed action.

4.5.9. American Marten

No marten were observed at any of the well pads or access road during the habitat assessment for the proposed action (Wildlife Dynamics 1994). All of the proposed well pads and access roads provide some form of habitat for the American marten. The effect of the proposed project would be to reduce the amount of area that could be used as habitat by the species. Given the limited acreage that would be affected by the proposed action, the reduction in potential habitat for the marten would not be expected to significantly affect populations or the range of this species. However, mitigation would be required for the removal of marten habitat.

4.5.10. Mule Deer

All of the proposed well pads and access roads would be within the summer range of the mule deer, and most of the sites provide at least marginal cover or foraging habitat. However, no mule deer were observed at any of the well pads or access roads during the habitat assessment for the proposed action (Wildlife Dynamics 1994). The effect of the proposed project would be to reduce the amount of area that could be used as habitat by the species. Given the wide-ranging nature of the mule deer, the limited acreage that would be affected by the proposed action, and the fact that the proposed action would not present significant barriers to migration or movement, implementation of the proposed POO would not significantly affect populations or the range of this species.

4.5.11. Other Species of Concern

Other species identified as species of concern by the USFS for the proposed action would not be adversely affected by implementation of the proposed POO. None of these species were observed at the well pads or access roads during the habitat assessment for the proposed action (Wildlife Dynamics 1994). Suitable habitat does not exist at any of the proposed well pad sites or access road corridors for the willow flycatcher or the Pacific western big-eared bat.

Only three well pads and associated roads (pads 18-32, 46-32, and 56-18) have the potential to contain necessary habitat components (i.e., large snags with thick, loose, and flaky bark) for the Myotis and Yuma Matist bats. However, potential removal of habitat components at these pads through implementation of the proposed action would represent an extremely small portion of suitable bat habitat in the vicinty. In addition, CEGC would resurvey the well pads prior to any construction activities at these pads to ensure that the pads are not occupied by Myotis or Yuma Matist bats and to identify any suitable habitat components. If suitable habitat components are identified at the pads, CEGC would avoid affecting these components where feasible by avoiding the components, slightly shifting the well pads, providing compensation, or implementing other measures specified by the USFS.

There has been one nesting bald eagle pair identified in the Bald Eagle Management Area (BEMA) at Medicine Lake. This pair has been known to occupy areas on the southern shore of the lake. Although wells 11-24TCH and 15-15TCH and associated access roads would be located either within or in close proximity to the BEMA, these wells would be located on the southern periphery of the BEMA in areas that are not known to be frequented by the nesting pair. In addition, 11-24TCH and 15-15TCH and associated access roads are not considered to be suitable habitat for this species.

MITIGATION MEASURES

Species-Specific Mitigation

Mitigation Measure 4.5.2.

For the northern spotted owl, seasonal restrictions will be imposed by the USFS for all proposed well pad and access road locations. Under these restrictions, no construction or

drilling may take place at the well pads between February 1 and August 15. For all well pads except for pad sites 63-20TCH and 15-15TCH, seasonal restrictions will be imposed until completion of protocol requirements (i.e., the second-year surveys). The second-year surveys will consist of site visits during the appropriate survey period. Upon completion of the surveys, one of two actions will be taken depending on the results of the surveys. If there are no owl responses, it will be determined that the proposed action would not have an effect on the owl, and the USFS will release the well pads from seasonal restrictions for owls. If there are owl responses, the USFS will require the seasonal restrictions as mitigation, and these restrictions will remain in place for those well pads that are in the vicinity of the responses.

The seasonal restrictions for pad sites 63-20TCH and 15-15TCH will remain in place for the life of the proposed action or until northern spotted owl protocol requirements are completed for these pads.

Mitigation Measure 4.5.3.

For the northern goshawk, seasonal restrictions will be imposed by the USFS for all proposed well pad and access road locations. Under these restrictions, no construction or drilling may take place at the well pads between February 1 and August 15. For all well pads except for pad sites 63-20TCH and 15-15TCH, seasonal restrictions will be imposed until completion of protocol requirements The goshawk surveys will consist of nesting surveys in May 1995. Upon completion of these surveys, one of two actions will be taken depending on the results of the surveys. If no goshawks or active goshawk nests are identified, it will be determined that the proposed action would not have an effect on the goshawk, the USFS will release the well pads from seasonal restrictions for goshawk, and the protocol would be deemed complete. If there are goshawk or active goshawk nests, the USFS will require that the seasonal restrictions be left in place until completion of the post-fledgling dependency period survey in early July through late August.

The results of the second surveys (if needed) will again result in one of two actions being taken. If there is no response during the second survey, it will be determined that the proposed action would not have an effect on the goshawk, and the seasonal restrictions for goshawk will be lifted. If goshawk presence is confirmed during the second survey, the USFS will require as mitigation that the seasonal restrictions remain in place for those well pads that are in the vicinity of the responses to avoid effects to goshawk.

The seasonal restrictions for pad sites 63-20TCH and 15-15TCH will remain in place for the life of the proposed action or until northern goshawk protocol requirements are completed for these pads.

Mitigation Measure 4.5.4.

For the American marten, CEGC will provide compensation mitigation for removal of marten habitat. Compensation mitigation will consist of placing d/d material from the well pads in concentrated debris piles near but somewhat isolated from the well pads, which will create denning sites for the marten. One to two piles per acre of disturbed

marten habitat will be provided. Approximate minimum dimensions of the piles will be eight feet wide by four feet tall by 10 feet deep. The extent of compensation and the locations of mitigation sites will be determined by field surveys conducted by the USFS and CEGC prior to any construction activities at well pads.

General Mitigation

Although the proposed action would not be expected to result in significant adverse effects to wildlife in general, the following mitigation measures are recommended to reduce potential effects to wildlife habitats during construction and operation of the proposed action.

Mitigation Measure 4.5.5.

Construction materials and equipment will arrive and leave all well pad sites by way of existing roads or through existing disturbed areas. Construction materials and equipment will not be allowed to cross areas that are to remain undisturbed. Construction materials and equipment will be stored within disturbed areas either at or near the well pad sites.

Mitigation Measure 4.5.6.

Where feasible, CEGC will top existing snags in adjacent areas to make these snags more suitable for use by wildlife species.

WILDLIFE EFFECTS OF ALTERNATIVES B, C, AND D

Alternative B

The overall potential for effects to wildlife would be reduced slightly under Alternative B compared to Alternative A due to the elimination of well pads 42-13TCH and 15-15TCH. There would be about 0.28 acres less area cleared for well pads under this alternative, which would reduce the loss to general wildlife habitat. Compared with Alternative A, Alternative B would have slightly reduced potential for effects to habitat for the northern goshawk, woodpeckers, the American marten, and mule deer. The alternative would not reduce potential effects to northern spotted owl habitat compared to Alternative A. Additional surveys for northern spotted owl and northern goshawk would still be required under this alternative to complete the survey protocol for these species. All wildlife mitigation measures would apply to this alternative.

Alternative C

The overall potential for effects to wildlife if Alternative C is implemented would be reduced compared to Alternative A due to the elimination of well pads 46-32 and 18-32 and the access road to well pad 46-32. There would be about 12 acres less area cleared for well pads and access roads under this alternative. Compared with Alternative A, Alternative C would slightly reduce potential effects to northern spotted owl habitat by eliminating clearing of some old growth trees, although spotted owls are not known to use those trees. Alternative C would have slightly reduced potential to affect habitat for the

northern goshawk, woodpeckers, the American marten, and mule deer. Additional surveys for northern spotted owl and northern goshawk would still be required under this alternative to complete the survey protocol for these species. All wildlife mitigation measures would apply to this alternative.

Alternative D

There would be no effects to wildlife from implementation of Alternative D, and no mitigation would be required.

4.6 Air Quality

SIGNIFICANCE CRITERIA

Federal and state ambient air quality standards have been established for criteria air pollutants (see Table 3.6-1). If emissions from a proposed action would exceed these standards, the action would be considered to have a significant effect. Emissions from a proposed action that significantly affect a Class I area would also be considered a significant effect.

Appendices G and I of the CEQA Guidelines indicate that a project could have a significant effect on the environment if it:

- Results in substantial air emissions or deterioration of ambient air quality
- Contributes substantially to an existing or projected air quality violation
- Exposes sensitive receptors to substantial pollutant concentrations
- Creates objectionable odors
- Alters air movement, moisture, temperature, or the local or regional climate

EFFECTS OF ALTERNATIVE A

4.6.1. Air Emissions During Construction Activities

The primary criteria air pollutant of concern during construction of the proposed action (i.e., grading of well pads and roads and construction-related vehicle travel) would be particulate matter in the form of fugitive dust. Emissions would primarily be caused by construction vehicles and equipment "kicking up" dust in the area. Wind erosion is not expected to occur due to the surrounding trees that serve as wind breaks and the relatively compacted surfaces of the roads and well pads (which have generally been sited on previous disturbed areas).

Air quality effects from construction activities at the well pads and access roads would be localized and temporary. Construction activities would increase particulate matter concentrations in the vicinity of each well pad (lasting one to two days for TCH pads, and about two weeks for exploration pads). These increases would be localized and short-term, and would not be expected to be significant. Because of the low background concentrations of particulate matter in the vicinity of the proposed action and the limited nature of construction activities, these activities would not result in exceedances of the

state or Federal AAQS. In addition, CEGC proposes to reduce dust generation by watering construction areas as necessary. Watering would minimize the localized increases in particulate matter concentrations.

Given the limited amount of vehicle use that would occur during construction activities, construction of the proposed action would not result in significant generation of other criteria air pollutants and would not be expected to exceed state or Federal AAQS.

4.6.2. Air Emissions During Drilling and Testing Activities

Criteria air pollutant emissions and geothermal fluid emissions would occur during well drilling and testing (see 4.6.3 for a discussion of hydrogen sulfide emissions). The primary source of criteria air pollutants during drilling would be from equipment and machinery operating at the sites, as well as vehicles associated with the drilling activities. There would be a limited amount of equipment, machinery, and vehicles located at the well sites, and the volume of emissions from these sources would be expected to be low. CEGC would equip all exhaust stacks on diesel and gas-driven equipment and vehicles with mufflers and utilize low-sulfur fuels to minimize air emissions. Drilling of the proposed wells would therefore not generate significant amounts of criteria air pollutants, and pollutant concentrations during drilling would not exceed state or Federal AAQS.

There would be no geothermal emissions from the TCH wells as they will not encounter the resource during drilling. Only exploration wells would have the potential to release geothermal steam to the atmosphere during drilling and testing. Intermittent geothermal steam emissions could occur during the last 15 to 20 days of drilling. Geothermal steam emissions could also occur during initial exploration well testing (which would last from 1 to 3 days) and long-term testing of the well (which would last 30 to 90 days). Two or more exploration wells could be tested at one time. Given the distance between the exploration wells, the emissions from different well pads would not combine. In addition, the steam produced from existing Glass Mountain geothermal wells has very low concentrations of non-condensable gases.

The emissions of criteria air pollutants from testing geothermal wells typically do not result in significant air quality impacts (NWC 1988; USFS et al. 1994). The primary constituent of concern in the geothermal steam is hydrogen sulfide (see the discussion below in 4.6.3). CEGC considers the steam analysis from the Glass Mountain wells to be proprietary (McClain 1994). The steam analysis was reviewed for this analysis. Concentrations of criteria air pollutants from these releases would not exceed state or Federal AAQS.

Pursuant to requirements of the SCAPCD for the proposed action, particulate emissions from operations would be controlled to less than 40% opacity through the use of mufflers, and water injection into the blooie line would be maintained to reduce particulate emissions. For any air drilling at exploration wells, injected water and a cyclone separator/muffler would be used to control particulates. The impacts of well testing will

also be reviewed by the SCAPCD in their review of the CEGC application for an Authority to Construct (ATC) permit for the proposed wells.

Vehicle travel during drilling and testing activities could result in localized and temporary increases in concentrations of fugitive dust, but would not exceed state or Federal AAQS.

4.6.3. Hydrogen Sulfide Emissions During Well Drilling and Testing

The primary emission of concern during well drilling and testing is hydrogen sulfide (H_2S). H_2S is a colorless, noncondensable gas with a characteristic "rotten egg" odor that can pose hazards to human health at sufficient concentrations. The SCAPCD has established a limit of 10 pounds per hour for the release of H_2S from a geothermal well source (Griffin 1994). H_2S can be released from a well during drilling activities and can be vented during testing activities at a well.

The proposed well drilling and testing would not result in releases of H_2S that would exceed standards, result in nuisances, or pose a human health hazard. Previous testing of the Glass Mountain geothermal resource has resulted in emissions of H_2S at a rate of approximately 2.8 pounds per hour (USFS et al. 1994), which is well below the emission threshold established by the SCAPCD. Well drilling and testing under the POO would be expected to result in approximately the same rates of H_2S emissions as previous testing. These emission rates would generate concentrations that would be well below the applicable state standard and that would not result in a potential hazard to human health.

Although there is the potential that H_2S odors would occasionally be detectable in the vicinity of the well pads during testing, it is not expected that these odors would pose a significant nuisance problem. The low emission rates of H_2S would result in low concentrations and odors that would be quickly dispersed and diluted to barely detectable or undetectable levels. Given the distance of the wells to the nearest summer residences and campgrounds at Medicine Lake (over one mile) and the natural topographical barriers between the wells and these areas, well drilling and testing would not generate H_2S odors that would adversely affect these areas.

To further ensure that there would be no H_2S effects from well drilling and testing, CEGC would monitor H_2S emissions from the wells and concentrations in the vicinity of the well sites and submit the results of this monitoring to the SCAPCD for their review. If H_2S emissions or concentrations exceed established limits, the SCAPCD would be authorized through the ATC/PTO permit for the proposed action to stop well drilling or testing activities until the excessive levels are abated. Worker health would be protected because H_2S emissions during drilling and testing would be monitored. The monitors would be equipped with alarms to indicate H_2S concentrations approaching hazardous levels. Respirators would be available at the drill rig. Although exceedances could occur on a short-term basis until the situation is abated, the authority to stop well drilling or testing activities would ensure that H_2S emissions and concentrations would not result in long-term exceedances of H_2S standards.

4.6.4. Class I Areas

In the vicinity of the proposed action, the two areas that comprise the Lava Beds National Wilderness Area are the only Class I areas. Both of these Class I areas are located approximately six miles north of the proposed action in the Lava Beds National Monument. A natural ridge line running east to west forms a barrier between the location of the proposed action and the Class I areas.

Winds in the area generally blow from northwest to southeast, which would prevent emissions from the proposed action from reaching the Class I areas. Winds would need to blow almost due north for project emissions to have the potential to reach the Class I areas. However, even in these conditions, the natural ridge line would block transport of the emissions to the Class I areas, and the variable topography between the proposed action and the Class I areas would further disperse emissions. The primary visibility-reducing emissions are particulates of about 2 microns in size and sulfate. The project emissions of visibility-reducing constituents would be very small and would not be expected to reduce visual range or contrast in the Class I area. The proposed action would therefore not have an adverse effect on Class I areas in the vicinity of the proposed action.

4.6.5. Public Health Effects

Based on previous analyses of the public health effects other geothermal exploration projects (NWC 1988; USFS et al. 1994), the proposed project would not adversely affect public health. The geothermal fluids at Glass Mountain that have been tested thus far show lower levels of contaminants than those at other geothermal fields, and no public health effects are expected.

EFFECTS OF ALTERNATIVES B, C, AND D

Alternative B

The air quality effects of Alternative B, elimination of pads 42-13TCH and 15-15TCH, would be similar to those of the proposed action (Alternative A). Activities at the other eight well pads would be the same as under the proposed action, and would have the same potential to affect air quality. However, there would be no localized dust emissions or increases in criteria air pollutant concentrations at pads 42-13TCH and 15-15TCH. Since these two sites would not be graded, there would be no fugitive dust generation from these sites, and no equipment or machinery would occupy the sites that could emit criteria air pollutants.

If Alternative B is selected, the potential for H_2S odors and health hazards would be the same as the proposed action because there would be no geothermal emissions from the TCH wells. The impacts to the summer residences and campgrounds at Medicine Lake would be the same as those under the proposed action.

Alternative C

The air quality effects of Alternative C, elimination of pads 46-32 and 18-32, would be similar to those of the proposed action (Alternative A). Activities at the other eight well

pads would be the same as under the proposed action, and would have the same potential to affect air quality. However, there would be no localized dust emissions or increases in criteria air pollutant concentrations at pads 46-32 and 18-32. Since these two sites would not be graded, there would be no fugitive dust generation from these sites, and no equipment or machinery would occupy the sites that could emit criteria air pollutants.

If Alternative C is selected, the potential for H_2S odors and health hazards would not occur at or in the vicinity of pads 46-32 and 18-32.

Alternative D

There would be no air quality effects from implementation of Alternative D.

4.7 Noise

SIGNIFICANCE CRITERIA

Federal and state noise regulations provide significance criteria for evaluating estimated noise levels. Federal standards for noise generated from geothermal projects are identified in Part 11.C. of the U.S. Department of Interior's GRO No. 4, which states that, in the absence of more restrictive criteria, noise levels from a geothermal operation at 0.5 miles (approximately 0.8 kilometers or 2,640 feet) or at the lease boundary (whichever is greater) shall not exceed 65 dBA.

According to Appendix G of the CEQA Guidelines, a project would normally have a significant effect on the environment if it would substantially increase the ambient noise levels of adjoining areas. Appendix I of the CEQA Guidelines indicates that a project will have a significant effect if it exposes people to severe noise levels. However, CEQA does not establish quantified thresholds for determining substantial or significant increases in noise levels.

EFFECTS OF ALTERNATIVE A

4.7.1. Pad and Road Construction Noise

Estimated noise levels at various distances from pad and access road construction are shown on Table 4.7-1. Noise from construction activities would be temporary in nature and would occur for very short durations (one to two days at the TCH well sites, and about two weeks at the exploration well sites). In addition, trees and the natural barriers formed by the topography in the vicinity of the proposed action would serve to attenuate (reduce) construction noise levels.

The noise-sensitive receptors closest to the proposed action are the summer residences and campgrounds located near Medicine Lake. These recreational facilities are located approximately one mile from the closest TCH well pad, and about 1.5 miles from the closest exploration well pad. As shown in Table 4.7-1, noise from construction activities at the summer residences and campgrounds would be less than 38 dBA, and well below the 65-dBA standard for geothermal operations. Noise levels experienced at the sensitive

Table 4.7-1: Typical Noise from Geothermal Exploration Activities

Activity	Noise Level (dBA)[1]					
	100 feet	200 feet	500 feet	1,000 feet	2,000 feet	5,000 feet
Site preparation and construction	78	73	66	58	50	38
Well drilling	75	68	60	53	44	30
Well clean-out	75	68	58	50	41	25
Flow testing	78	73	66	59	52	42

Notes:
[1]Identified noise levels are given for various distances from a proposed noise-generating source. These noise levels do not account for the topographical barriers and trees throughout the project vicinity, both of which absorb or deflect sound waves, thereby reducing noise levels.

SOURCE: CEGC 1994

receptor sites would be expected to be lower than 65 dBA due to the sound-muffling properties of the Forest.

Since construction noise would be temporary and below the 65-dBA standard at the closest receptors, this noise would not be considered to substantially increase the ambient noise levels in the area and would not expose people to severe noise levels. Noise from construction would therefore not adversely affect noise-sensitive receptors in the vicinity.

4.7.2. Traffic Noise

Vehicles associated with construction, drilling, and testing of the well sites would generate intermittent noise throughout the vicinity of the proposed action. Vehicle noise would occur sporadically and would not result in substantial increases in ambient noise levels or expose people to severe noise levels.

4.7.3. Well Drilling Noise

Estimated noise levels at various distances from well drilling activities are shown on Table 4.7-1. All well drilling equipment would be maintained and muffled to ensure compliance with the Federal Occupational Safety and Health Act of 1970 and GRO No. 4. Drilling noise and equipment operations would be limited in duration (approximately 60 to 90 days at each site).

Sound pressure level (SPL) surveys have been conducted to measure the effect of geothermal drilling operations on ambient noise levels at geothermal well sites that are in a noise environment similar to that of the proposed action (Reeder 1986). SPLs were measured at these well sites before and during drilling operations. The results of the SPL surveys give an approximate range within which the noise levels of drilling operations are

measurable, and beyond which these noise levels blend into ambient noise levels found under normal conditions.

Prior to drilling, the ambient SPL at all geothermal well sites was generally recorded at between 20 and 30 dBA, which is typical for a rural area. During drilling, the SPL at the well sites was between 70 and 80 dBA, with a maximum reading of 81 dBA immediately next to the noise source at the well site. At a distance of 1,000 feet from the geothermal well sites, the measured SPL was below 40 dBA during drilling. An SPL of 40 dBA or less is judged to be a quiet environment. At a distance of 0.5 miles from the well sites, measurements made during drilling operations were approximately 28 dBA, or within the normal range of noise levels measured prior to drilling operations (Reeder 1986).

Noise levels from drilling activities under the proposed POO would be expected to be similar to those identified during the SPL surveys. As shown in Table 4.7-1, noise levels from drilling activities would not exceed 65 dBA at the closest receptors and would be in accordance with GRO No. 4. Trees and the natural barriers formed by the topography in the vicinity of the proposed action would serve to attenuate (reduce) well drilling noise levels. Noise levels from drilling would therefore not be considered to substantially increase the ambient noise levels in the area and would not expose people to severe noise levels.

4.7.4. Well Testing Noise

Estimated noise levels at various distances from exploration well testing activities are shown on Table 4.7-1. TCH wells would not be tested as they would not be drilled to reach the geothermal reservoir. Well testing would only occur at exploration wells. The exploration well pad closest to the summer residences and campgrounds near Medicine Lake is pad 13-18, which is located about 1.5 miles from these recreational facilities.

All well testing equipment would be maintained and muffled to ensure compliance with the Federal Occupational Safety and Health Act of 1970 (OSHA) and GRO No. 4. As shown in Table 4.7-1, noise from well testing activities would be expected to be below the 65-dBA standard at the closest noise-sensitive receptors. Ambient noise at the receptors during testing could be in the range of 25 to 35 dBA, which would be similar to the existing noise environment in the vicinity of these receptors. Trees and the natural barriers formed by the topography in the vicinity of the proposed action would serve to attenuate well drilling and testing noise levels. Noise from well testing activities would not expose people to severe noise levels and would not be considered a substantial increase in ambient noise levels. Increases in noise levels would therefore not adversely affect noise-sensitive receptors in the vicinity.

Ambient noise levels in the immediate vicinity of the well pads would be expected to increase during well testing activities. However, these increases in noise levels would only occur during testing and would be temporary in nature. As stated earlier, noise levels from well testing activities are expected to be in compliance with the Federal OSHA and GRO No. 4.

4.7.5. Noise Effects on Animal Species

Estimated noise octave and spectra from geothermal exploration activities are shown on Table 4.7-2. During exploration activities, some animals may avoid habitats in the vicinity of the proposed action due to the increased noise levels, particularly if a species is sensitive to a frequency range that the various geothermal exploration activities would generate. However, since proposed activities would be sporadic and temporary in nature, any avoidance of habitats in the vicinity of the proposed action by general wildlife species would also be temporary.

EFFECTS OF ALTERNATIVES B, C, AND D

Alternative B

The overall noise effects of Alternative B, elimination of pads 42-13TCH and 15-15TCH, would be similar to those of the proposed action (Alternative A). Construction, traffic, drilling, and testing noise would still occur under Alternative B. Although the two TCH well pads would be eliminated, activities at the other eight well pads would be the same as under the proposed action, and would have the same potential to generate noise.

During construction and well drilling, noise levels at the noise-sensitive receptors located near Medicine Lake would be expected to be less since construction and well drilling would not occur at pads 42-13TCH and 15-15TCH under Alternative B. Since no exploration pads would be eliminated under this alternative, noise from well testing would be the same as described for the proposed action.

Table 4.7-2: Estimated Noise Octave and Spectra from Geothermal Exploration Activities[1]

		Octave Band Center Frequency (cps)[2]								
Activity	Distance	31.5	63	125	250	500	1,000	2,000	4,000	8,000
Site preparation and construction	50	82	82	87	85	82	78	75	71	60
Well drilling	150	84	85	86	80	69	68	65	63	63
Well clean-out	150	70	76	84	91	92	92	90	91	82
Flow testing: max	150	74	80	88	95	96	96	94	95	86
min	150	68	75	85	91	91	91	86	86	76

Notes:

[1]Estimated noise spectra is expressed as sound pressure level in dB re 0.0002 microbar; the spectra in this table does not account for the topographical barriers and trees throughout the project vicinity, both of which absorb or deflect sound waves, thereby reducing noise levels.

[2]cps = centimeters per second.

SOURCE: CIEA 1995

Alternative C

The overall noise effects of Alternative C, elimination of exploration well pads 46-32 and 18-32, would be similar to those of the proposed action (Alternative A). Construction, traffic, drilling, and testing noise would still occur under Alternative C. Activities at the other eight well pads would be the same as under the proposed action, and would have the same potential to generate noise. However, the elimination of the two well pads under Alternative C would eliminate noise generation from these sites, and increases in ambient noise levels in the immediate vicinity of these sites would not occur.

Given the distance of pads 46-32 and 18-32 from the noise-sensitive receptors located near Medicine Lake, implementation of Alternative C would not be expected to result in a noticeable difference from the proposed action in noise levels at the receptors during construction and well drilling activities. However, since the elimination of pads 46-32 and 18-32 would eliminate well testing at these pads, noise levels at the receptors near Medicine Lake during well testing activities would be expected to be less under Alternative C.

Alternative D

There would be no noise effects from implementation of Alternative D.

4.8 Visual Resources

SIGNIFICANCE CRITERIA

A project would be considered to have a significant effect if it were not consistent with USFS designated visual quality objectives (VQOs) which provide standards for visual management of Forest lands. In addition, CEQA Guidelines consider that a project would have a significant effect if it would obstruct any scenic vista or view open to the public or create an aesthetically offensive site open to public view.

EFFECTS OF ALTERNATIVE A

4.8.1. Long-Range Views From Surrounding Vantage Points

The proposed action would create both short-term and long-term physical changes to the forest environment that may be visible from vista and vantage points in the surrounding area.

Visual Elements of the Proposed Action: Areas cleared for access roads could create a break in the tree line when viewed from long-range vantage points. However, the forest is characterized by numerous logging roads and the majority of the well pads would be accessed via existing logging roads. Road renovation along these existing roads would require clearing and grading of reemergent vegetation. Removal of this vegetation would not result in noticeable long-range visual contrast compared to existing conditions. New road construction would be required at two well pads: 46-32, and 42-13. However, since new and improved road widths would be only approximately 14 feet wide, the resulting break in the tree line would result in a minimal level of visual contrast from long-range

vantage points. This is especially true since previous logging activity has resulted in a forest canopy characterized by numerous breaks in the tree line. Access roads would therefore be a long-range visual feature of the proposed action that would not create a significant visual impact.

Clearing of vegetation for exploration well pads could create a noticeable break in the tree line when viewed from long-range vantage points. Well pads for TCH wells would require smaller areas of disturbance than exploration well pads, and would result in a lower potential for visual impact. All of the exploration well pads contain some large trees that would need to be cleared; however, all but one of the well pads (46-32) would be constructed in areas that have been previously logged. These areas are characterized by reemergent vegetation and replanted conifers, along with some larger trees. The variation in the height of the trees creates an existing interrupted tree line. Clearing these areas and grading the well pads would result in minimal if any visual impact to long-range views.

During the drilling phase of the proposed action, drill rigs and associated equipment would occupy the well pads. The primary visual feature during this phase would be the tower of the drill rig. Large rigs used for exploration drilling are about 140 feet high and the smaller rigs used for drilling temperature core holes are about 90 feet high. Depending on the size of the trees in the vicinity of the well pads, the tops of the drill rigs may be visible from long-range vantage points, especially for the larger rigs. Rigs would be lighted at night and night lighting could be visible from some vantage points. Exploration rigs would be visible at well pads for a period of 30 to 90 days for each well. Temperature core hole rigs would be visible for 25 to 60 days at each site. Given the short time period that drill rigs could be visible, this would not be considered a significant impact.

Once the well is completed and the drill rig is removed, testing would occur at each exploration well for a period of 30 to 90 days. Temporary facilities would be constructed during the testing phase; the largest piece of equipment would be the atmospheric separator, which is about 30 feet tall. During this period, a steam plume could be visible from surrounding vantage points. Since testing would be expected to occur in the summer months when the air is driest, the height of the plume would range from 40 to 150 feet above the separator. The plume would be largest in the morning when the humidity is highest. From long-range vantage points, the steam plume would be visually subordinate to the surrounding landscape and would not create a significant effect. After completion of testing at exploration well pads, the well(s) could be capped for future use as either a production or injection well, or could be shut in and the well pad reclaimed. This decision would be part of the utilization phase of geothermal development and would be covered under future environmental documents. Until well pads are reclaimed, they could remain slightly visible from long-range vantage points.

Temperature core holes would not be flow-tested, so no large pieces of equipment or atmospheric venting would be required. Testing would therefore not create significant visual effects. After completion of testing at temperature core holes, the well would be shut in. At decommissioning, the well pad would be regraded and revegetated to the extent possible, but reemergent vegetation would not reach full growth for a relatively

long time period. During this period, the well pad would continue to create a visual contrast with the surrounding area. However, given the small size of the TCH well pads, and the previous logging disturbance that exists at the sites, visual contrasts would not be significant.

Vantage Points: The primary long-range vantage points from which project features could be visible are the peaks surrounding the Medicine Lake caldera. These include: Mount Hoffman, Little Mount Hoffman, Medicine Mountain, Glass Mountain, Badger Peak, and Redshale Butte. All of these peaks, with the exception of Little Mount Hoffman, are forested and long-range views are intermittent, with many views obstructed by tree cover. Little Mount Hoffman does not have heavy tree cover and provides unobstructed long-range views of portions of the project area.

Most of the identified vantage points are in unroaded areas, and views from these vantage sites would be experienced only by hikers or other recreational users. At any given time, a maximum of two exploration drill rigs and one temperature core hole rig would be operating. Occasional views of tree breaks or the tops of drill rigs for short periods during drilling would not significantly degrade views from these vantage points. There are no vantage points from which three well pads could be viewed at the same time. Little Mount Hoffman is accessible via a USFS road accessing a lookout station and therefore provides views to a greater number of travelers than any of the unroaded vantage points. However, Little Mount Hoffman is the westernmost vantage point and is two miles from the nearest well pad site. Additionally, all of the well pads except 15-15TCH have topographic obstructions that would obstruct views from Little Mount Hoffman. 15-15TCH may be visible from this vantage point, but it is over two miles away and is a relatively small TCH pad located in a logged area. Views from Little Mount Hoffman would not be noticeably altered by any of the short- or long-term features of the proposed action.

The residences on the east side and campgrounds on the northern edge of Medicine Lake are located in the lowest topographic portion of the Medicine Lake caldera. The proposed access roads and well pads would be located at higher elevations, or would be screened by topographic features; therefore, none of the project features would be visible from the Medicine Lake area.

4.8.2. Short-Range Views

The same elements of the proposed action that could be visible from long-range vantage points could also be visible from short-range viewing points and routes of travel.

The primary travel routes in the project area are Primary Forest Route (PFR) 97 and Forest Roads 43N48 and 44N75. There are several additional Forest Roads in the area, none of which is heavily trafficked. Three temperature core hole pads, 34-8TCH, 42-13TCH, and 11-24TCH, would be located relatively close to forest roads. However, the potential for visual impacts at these sites would be minimized by relatively small size of the pads and the screen of trees that would be left between the road and the well pad. Exploration well pad 56-18 is close to PFR 97. At this location, the drilling rig may be visible to travelers

during the 90-day drilling period. All other pads would be located far enough from roads that they would not be visible from the roads.

All of the well pads and drilling and testing equipment would be occasionally visible to hikers and other recreational users in the immediate vicinity of the well pad. However, the main visible component of the proposed action, the drill rig, would be at the site for a short time period and would therefore not significantly affect views. After testing, the main feature in short-range views of the well pad would be a flat clearing. Visibility of the well pads and drilling rigs from short-range views would not result in significant visual effects.

4.8.3. Consistency With VQOs

Table 3.8-1 shows the VQO designations for the proposed well pad sites. None of the proposed well pad sites are designated for Preservation, the strictest designation.

Retention: Two exploration well pad sites, 18-32 and 56-18, are located in areas with a VQO designation of Retention (see Table 3.8-1). Under this designation, project activities may occur, but should not be visually evident to the casual observer. The designation specifies that efforts to reduce visual contrast should be accomplished during project operation or immediately thereafter.

Well pads 18-32 and 56-18 are located away from roadways and would not be visible to the casual observer. The temporary nature of the drilling operation would be consistent with an effort to reduce visual contrast immediately, as would the revegetation of the well pads that would occur upon completion of the project. The proposed action would therefore be consistent with the objectives for this designation.

Partial Retention: Four temperature core hole sites, 42-13TCH, 11-24TCH, 63-20TCH, and 15-15TCH, and two exploration well pads, 46-32 and 13-18, are located in areas designated Partial Retention. Under this designation, project activities should remain visually subordinate to the characteristic landscape, but may introduce some contrasting visual elements to the landscape. The designation specifies that efforts to reduce visual contrast should be accomplished as soon as possible after project completion or within the first year.

The clearing of well pads 42-13TCH, 11-24TCH, 63-20TCH, 15-15TCH, 46-32, and 13-18 would not introduce a dominant feature to the characteristic landscape. The temporary nature of the drilling operations at the well pads would be consistent with the objectives of this designation, as would the revegetation of the well pads that would occur upon completion of the project.

Modification: One temperature core hole site, 34-8TCH, and one exploration well pad, 58-6, have VQO designations of Modification. Under this designation, project activities may dominate the landscape; however, project activities should retain visual elements of

the surrounding area to the extent possible. The designation specifies that efforts to reduce visual contrast should be accomplished within the first year following project completion.

Well pads 34-8TCH and 58-6 would be the main long-term feature of the proposed action and would not be dominant features in the characteristic landscape. In addition, the temporary nature of the drilling operation would be consistent with the objective of reducing visual contrast as soon as possible, as would the revegetation of the well pads that would occur upon completion of the project.

EFFECTS OF ALTERNATIVES B, C, AND D

Alternative B

The overall visual impacts of Alternative B, elimination of pads 42-13TCH and 15-15TCH would be slightly reduced compared to the proposed action (Alternative A). This alternative would be consistent with VQOs designations. The two TCH pads eliminated under this alternative would be potentially visible from Little Mount Hoffman. This alternative would therefore slightly reduce potential long-range views from this vantage point. Elimination of the two well sites would also slightly reduce potential short range visual effects.

Alternative C

The overall visual impacts of Alternative C, elimination of pads 46-32 and 18-32, would be slightly reduced compared to the proposed action (Alternative A). This alternative would be consistent with VQOs designations and would eliminate one well pad with the Retention designation (18-32). Elimination of the two exploration well pads would eliminate the potential for the temporary visual impact of the drill rig being seen above the tree line during the drilling process. The two well pads that would be eliminated are away from routes of travel and would not be expected to be visible in short-range views. Potential reductions in short-range visual effects would therefore be minimal.

Alternative D

There would be no visual impacts from implementation of Alternative D.

4.9 Land Use, Recreation, and Transportation Systems

SIGNIFICANCE CRITERIA

A proposed action may have a significant effect on the environment if it would not be compatible with existing land uses of an area or cause an actual physical change to the environment as a result of a conflict with adopted environmental plans and goals for the area in which it is located (in this case, the Modoc National Forest). In addition, according to the CEQA Guidelines, a proposed action may have a significant effect on the environment if it would:

- Disrupt or divide the physical arrangement of an established community

- Conflict with established recreational, educational, religious, or scientific uses in an area
- Result in a substantial alteration of the present or planned land use of an area

A proposed action that would cause an increase in traffic that is substantial in relation to the existing volumes and capacity of the road network would be considered to have a significant adverse effect. In addition, the USFS considers destruction of existing roadways in the Modoc National Forest by heavy truck use to be a significant adverse effect.

EFFECTS OF ALTERNATIVE A

4.9.1. Existing Land Uses

The proposed action would not be expected to conflict with existing land uses in the vicinity. Development of the TCH and exploration well pads would be a continuation of the existing geothermal exploration that has occurred in the vicinity of Medicine Lake over the last 15 years. The new access roads that would be develop in the area would be a continuation of the existing road network development that currently exists in the area. Access roads would be gated to control access by unauthorized persons. The proposed action would not be expected to conflict with Native American uses in the vicinity (see 4.3.3 in Section 4.3, Cultural Resources).

The proposed action would occupy a relatively small area (approximately 29.6 acres) within the Modoc National Forest. Since the well pads would be dispersed throughout the vicinity of the proposed action, there would not be an excessive concentration of development at any one location. The proposed action would therefore not be considered to represent a substantial alteration of the present land uses in the area.

Noise generated by implementation of the proposed action would not be expected to adversely affect other land uses in the vicinity (see Section 4.7, Noise). In addition, the proposed action would not be expected to emit H_2S odors that would adversely affect other land uses (see Section 4.6, Air Quality), and would not be expected to result in adverse visual effects (see Section 4.8, Visual Resources). A discussion of the compatibility of the proposed action with recreational uses in the vicinity is discussed in 4.9.4, Recreation.

4.9.2. Consistency with Plans

Lease Stipulations: The proposed action would be would be consistent with the lease stipulations for Federal Geothermal Leases CA-12367, CA-12370, CA-12371, CA-12372, CA-1224, and CA-2500. Only one well pad (pad 42-13TCH on lease CA-12371) is located within a no surface occupancy lease stipulation area. This stipulation prohibits occupancy of the specified portion of the lease area if the proposed POO would result in significant adverse impacts related to recreational uses. As discussed in this section under 4.9.4., Recreation, implementation of the proposed POO would be a short-term temporary effect that would not significantly effect recreational uses in the area. Development of well pad 42-13TCH would therefore not have a significant adverse impact on recreational uses, and

would therefore not conflict with the no surface occupancy lease stipulations carried by CA-12371. No activities are proposed under the POO for any other portions of the leases that carry a no surface occupancy lease stipulation.

Modoc National Forest Plans: The proposed action would be consistent with the policies and management direction contained in the USFS *Modoc National Forest Land and Resource Management Plan* (USFS 1991a). The Plan identifies standards and guidelines for the Forest. The proposed action would be consistent with Guideline 10.1, which encourages exploration of mineral resources. The standards and guidelines in the Plan specifically for the Medicine Lake area state that geothermal development should not be precluded by other management activities, and that habitat for the marten should be maintained during geothermal exploration activities.

President Plan: The proposed action would not conflict with the President Plan, which provides standards and guidelines for the management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl (this document is also known as "Option 9" due to the selection of the Option 9 Alternative as the preferred alternative) (USFS and BLM 1994b). The project area is located in a matrix area (i.e., outside of designated late-successional reserves and other old growth management areas) on the extreme eastern edge of the range of the spotted owl, on the edge of the "CA Cascade" physiographic province, as delineated in the President Plan. The proposed action would be consistent with standards and guidelines for matrix areas, including providing a supply of coarse woody debris (i.e., d/d logs) and avoiding the fragmentation of old growth stands in areas where few old growth stands remain.

In addition to providing standards and guidelines, the Option 9 document specifies that three late-successional territories be delineated in the Medicine Lake area. These territories are currently being delineated by the USFS, and proposed territories have been identified. One of the proposed late-successional territories is in the vicinity of Medicine Mountain, and includes one of the proposed TCH well pads (11-24TCH). Since these well pads are located on previously disturbed areas and development of these well pads would not require the clearance of late-successional or old-growth vegetation, implementation of the proposed action would be consistent with the Option 9 document.

4.9.3. Mount Hoffman Roadless Release Area

Within the 10,800-acre Mount Hoffman Roadless Release Area (RRA), two well pads (18-32 and 46-32) and a 2,200-foot road to well pad 46-32 would be constructed. These facilities would occupy about 12 acres within the RRA. The 12 acres would represent approximately 0.1% of the total acreage of the RRA in a relatively confined area near the perimeter of the RRA. Given the location and relatively small size of these well pads and road, development of these facilities would not affect the future consideration of this area as a Federal Wilderness Area.

Section 20.6.3 of the USFS *Environmental Policy and Procedures Handbook* (USFS 1992) states that proposals that would substantially alter the undeveloped character of an inventoried

roadless area of 5,000 acres or more require the preparation of an Environmental Impact Statement (EIS). As an example of such a proposal, Section 20.6.3(a) of the Handbook identifies the construction of roads and harvesting timber that would affect approximately 5% (3,000 of 56,000 acres) of a roadless area in only one part of the roadless area. The well pads and road that would be constructed in the Mount Hoffman RRA as part of the proposed action would occupy a percentage of the roadless area (0.1%) that is well below the 5% threshold identified in the USFS Handbook.

4.9.4. Recreation

Well pads and access roads have been sited either in or adjacent to areas that have received previous disturbance from logging or other activities. Although exploration activities at the well pads may be observed by recreational users in the area, proposed activities would not significantly affect the recreational experience of these users (see Section 4.8, Visual Resources).

Activities at the well pads would not conflict with developed recreation uses located at Medicine Lake (see Section 4.6, Air Quality, Section 4.7, Noise, and Section 4.8, Visual Resources). The proposed action would not affect lake levels or water quality at Medicine Lake (see Section 4.4, Hydrology), and would therefore not affect water-related recreational uses at the lake.

Dispersed recreation uses could be affected by implementation of the proposed action. Drilling and testing activities at the well pads could alter the use patterns of big game animal species in the vicinity, which could affect hunting opportunities. Camping, hiking, and other recreational activities in dispersed recreation use areas could be affected due to the implementation of proposed geothermal exploration activities in these areas. The potential for effects to dispersed recreation use would be greatest at well pads 46-32 and 18-32 since these sites lie on the periphery of the currently defined geothermal exploration area and would include well testing that could last for several years. However, given the limited area that would be affected by geothermal exploration and the many areas available for dispersed recreation use in the Modoc and Shasta Trinity National Forests, the proposed action would not significantly affect dispersed recreation use.

The summer season is the period of greatest recreational use in the vicinity of the proposed action, particularly at Medicine Lake. Road 43N48 (located along the northern shore of Medicine Lake) provides the main access route to the campground areas at the lake. If vehicles associated with the proposed action (particularly water and other trucks accessing well pads 15-15TCH and 63-20TCH) use Road 43N48, there is the potential that these trucks could conflict with recreational uses at the campgrounds and with recreational motorists accessing these areas.

4.9.5. Transportation Systems

The proposed action would not be expected to significantly increase vehicle movements in the vicinity of the proposed action. Drilling activities at each TCH well would be expected to generated a maximum of six to eight round trips per day, which includes two to four

water truck deliveries. Monitoring at each TCH well would generate about three or four round trips per day. At the exploration wells, each well site would generate approximately 20 round trips per day during drilling and about four round trips per day during testing. Given the current capacities and low use of roads in the vicinity, the additional trips generated by the proposed action would not be expected to adversely affect the transportation network in the vicinity of the proposed action.

During the winter months, the project area receives a significant amount of snowfall that prohibits use of area roads. These roads are generally not cleared of snow until late spring (usually in May), and the area is only accessible through the use of vehicles such as snowmobiles during the winter. Access to the well pads for drilling activities during winter months is therefore not proposed under the POO (unlike utilization or development, geothermal exploration does not require winter access to project sites). If winter conditions persist in the area (i.e., if a large snowfall or cold conditions extend the period that snow remains on the ground), there is the potential that CEGC would request road clearance in order to access the well pads. CEGC would coordinate any requested road clearance with the USFS. Since CEGC access would not be required before late spring, the proposed action would not require significant snow removal and would not open up access to the Medicine Lake area significantly earlier than currently occurs.

CEGC has proposed to construct a new access road to well pad 56-18 from PFR 97, which is maintained by Modoc County. There is the potential that traffic entering or exiting the new access road to well pad 56-18 could create a safety hazard since the access road would intersect PFR 97 on a curved section of the roadway.

The USFS is concerned that heavy truck loads associated with the proposed action could break up and destroy the thin surface pavement along Road 43N48, which runs along the northern shore of Medicine Lake (Sharp 1994). This could make the road unusable for recreational users attempting to access the recreational areas near Medicine Lake.

MITIGATION MEASURES

Mitigation Measure 4.9.1.

All heavy vehicles associated with the proposed project (particularly water and other trucks accessing well pads 15-15TCH and 63-20TCH) will avoid using Road 43N48 in order to avoid potential damage to this road and to minimize the potential for conflicts between vehicles associated with the proposed action and recreational uses and motorists associated with the Medicine Lake campgrounds. Water for activities at these well sites will either be obtained from existing sources west of the well sites or trucked from the Arnica Sink wells on roads to the north of Road 43N48.

Mitigation Measure 4.9.2.

CEGC will submit design plans to Modoc County and the USFS for the intersection of the access road for pad 56-18 and PFR 97 to ensure that traffic at the intersection will not create a public safety hazard.

EFFECTS OF ALTERNATIVES B, C, AND D

Alternative B

The overall effects to land use, recreation, and transportation systems of Alternative B, elimination of pads 42-13TCH and 15-15TCH, would be similar to those of the proposed action (Alternative A). Construction, traffic, drilling, and testing would still occur at the other eight sites under Alternative B. Although the two TCH well pads would be eliminated, activities at the other eight well pads would be the same as under the proposed action. Since well pad 63-20TCH would be drilled under Alternative B, potential effects from truck travel on Road 43N48 would still occur. However, by eliminating two well pads, less surface disturbance would occur, and there would be less of a potential to affect dispersed recreation uses in the area.

Alternative C

The overall effects to land use, recreation, and transportation systems of Alternative C, elimination of exploration well pads 46-32 and 18-32, would be similar to those of the proposed action (Alternative A). Construction, traffic, drilling, and testing would still occur under Alternative C. Although the two exploration well pads would be eliminated, activities at the other eight well pads would be the same as under the proposed action, and potential effects from truck travel on Road 43N48 would still occur. However, by eliminating well pads 46-32 and 18-32, less surface disturbance would occur.

Well pads 46-32 and 18-32 are located in a relatively more remote portion of the Forest than the other well pads. Eliminating these well pads under Alternative C would result in less potential to affect dispersed recreation uses in the area.

Alternative D

There would be no effects to land use, recreation, or transportation systems from implementation of Alternative D.

4.10 Socioeconomics

SIGNIFICANCE CRITERIA

The proposed action could have an adverse effect if it would:

- Induce substantial growth or concentration of population, employment, or demand for housing
- Substantially decrease property values in the vicinity

EFFECTS OF ALTERNATIVE A

4.10.1. Population

The proposed action would occur over approximately three to four years. Over the three to four year period, the increase in population resulting from the proposed action would depend on the number of exploration wells or TCH wells drilled simultaneously. At a

maximum, two exploration wells and one TCH well would be drilled simultaneously. The increase in population is expected to be due to the influx of temporary workers. During maximum activities, the proposed action would create a demand for approximately 66 temporary workers.

Approximately 10% to 50% of the drill crews, suppliers, and subcontractors and all of the employees for road and well pad construction would be drawn from the local labor pool. CEGC would supply all supervisory and technical personnel. A worst-case population increase would occur if only 10% of the drill crews, suppliers, and subcontractors were drawn from the local labor pool. The resulting temporary population increase would be about 43 persons; this number could vary depending on the amount of local labor utilized.

The addition of 43 persons to the populations of Modoc and Siskiyou Counties would represent short-term population increases of 0.42% and 0.1% respectively, which would not have an adverse effect on population levels.

4.10.2. Employment

Drilling and testing of the TCH and exploration wells would generate employment opportunities. Employees needed for these activities are identified in Table 4.10-1. The administrative staff, geologist, and mud engineer would be utilized during all of the simultaneous drilling and testing activities and are listed separately in Table 4.10-1. As

Table 4.10-1: Well Drilling and Testing Employment[1]

Position	TCH Well (per day)	Exploration Well (per day)	Exploration Well Testing (per day)	Well Drilling and Testing[2]
Supervisor	1	1		
Drilling Contractor	1	1		
Drilling Crew	9	10		
Technical Staff		4	1	
Subcontractors	1	6		
Administrative Staff[2]				2
Geologist[2]				1
Mud Engineer[2]				1
Equipment Maintenance	1	1	2	
Total Employees	13	23	3	4

Notes:
[1]For each type of geothermal activity.
[2]These employees would provide on-call services for well drilling and testing.
[3]Includes personnel associated with water trucks, cement trucks, and pump trucks.

SOURCE: CEGC 1994

indicated in this table, each TCH would require 13 employees per day, each exploration well would require 23 employees per day, and well testing would require approximately three employees per day. There would be four employees that would serve as on-call employees for TCH drilling, exploration well drilling, and well testing. At a maximum, two exploration wells and one TCH well would be drilled simultaneously. The proposed action would employ approximately 66 persons during the maximum drilling and testing activities.

CEGC would utilize local contractors for road and well pad construction, road maintenance and for general labor such as setting up well testing equipment and water lines. During road and well pad construction, it is estimated that approximately 5 to 10 local contractors would be used. Approximately 10% to 50% of the drill crews, suppliers, and subcontractors would be expected to be drawn from the local labor pool. CEGC would supply all supervisory and technical personnel.

It is estimated that the proposed action would generate approximately $1,125,000 to $1,752,500 in salaries for employees (McClain 1994). Overall, the proposed action would provide positive economic and employment effects to the area.

4.10.3. Housing/Accommodations

Although all of the well pads are located within Siskiyou County, it is possible that temporary employees required for the proposed action could seek accommodations in both Modoc and Siskiyou Counties. Approximately 43 employees would require some form of temporary housing. The remaining employees are expected to be drawn from the local labor pool.

There are 962 available housing units (including mobile homes) in Modoc County and 2,737 in Siskiyou County (California Department of Finance 1992). Siskiyou County has approximately 20 RV Parks (Breedon 1994), and Modoc County has approximately 10 RV Parks (Heiser 1994). There are also several motels in the area that could be used for accommodations.

The 43 temporary accommodations that would be needed to house employees not drawn from the local labor pool could be supplied by existing housing units, RV parks, and motels. Implementation of the proposed action would therefore not adversely affect housing or other accommodations in the region.

4.10.4. Property Values

There are about 100 homes in the vicinity of the proposed action, all located near Medicine Lake. These homes are used as recreational or second homes and are not occupied year round. The closest well pads to the homes are 42-13TCH, 11-24TCH, and 15-15TCH. These well pads are located from one to two miles from the summer homes at Medicine Lake. Property values of these homes range from about $30,000 to $125,000 and depend on the condition of the home, type of improvements, and the date of the last property appraisal (Sharp 1994).

The proposed action would not adversely affect property values of the homes at Medicine Lake. Activities at the well pads would not result in adverse noise or air quality effects at these homes, and would not be visible from these homes (see Section 4.6, Air Quality, Section 4.7, Noise, and Section 4.8, Visual Resources). Since the proposed action would not significantly affect recreational uses in the area (see Section 4.9, Land Use, Recreation, and Transportation Systems), the desirability of the vicinity of the proposed action as a recreational area and summer retreat would not be affected. Property values would therefore be unaffected by implementation of the proposed action.

EFFECTS OF ALTERNATIVES B, C, AND D

Alternative B

By eliminating development of two well pads (42-13TCH and 15-15TCH), Alternative B would result in fewer employment opportunities in the region than the proposed action (Alternative A). Alternative B would also generate less of a increase in temporary population and demand for temporary housing and accommodations than the proposed action. Alternative B would have the same potential to affect property values as the proposed action.

Alternative C

Alternative C (elimination of well pads 46-32 and 18-32) would result in fewer employment opportunities in the region than the proposed action (Alternative A). Alternative C would also generate less of a increase in temporary population and demand for temporary housing and accommodations than the proposed action. Alternative C would have the same potential to affect property values as the proposed action.

Alternative D

There would be no socioeconomic effects from implementation of Alternative D.

4.11 Unavoidable Adverse Impacts

Based upon the analysis conducted for this document, a number of unavoidable adverse effects were identified. Those impacts that cannot be avoided include:

- Surface disturbance of 29.6 acres, changes in topography, and increased erosion
- Exposure of workers to the potential for natural seismic and volcanic hazards during well construction, drilling, and testing
- Removal of scattered old growth trees and loss of potential habitat for sensitive wildlife species
- Release of air emissions during well construction, drilling, and testing
- Increase in noise during well construction, drilling, and testing
- Views of the proposed action from long-range and short-range viewpoints
- Reduction in the quality of recreation experience in the vicinity of the proposed action during well construction, drilling, and testing

- Temporary increase in traffic from construction-related and operational activities
- Temporary increase in population and employment in the vicinity of the proposed action

Each of these effects is discussed in detail in Sections 4.2 through 4.10. None of these effects is considered to be significant. These unavoidable effects would occur under Alternatives A, B, and C.

4.12 Cumulative Impacts

Both NEPA and CEQA require the consideration of cumulative impacts. Cumulative impacts are defined as two or more individual effects which, when considered together, are considerable, or which compound or increase other environmental effects.

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 following analysis of cumulative impacts are other geothermal projects and other forest activities that may occur at the same time as the proposed action.

GEOTHERMAL PROJECTS

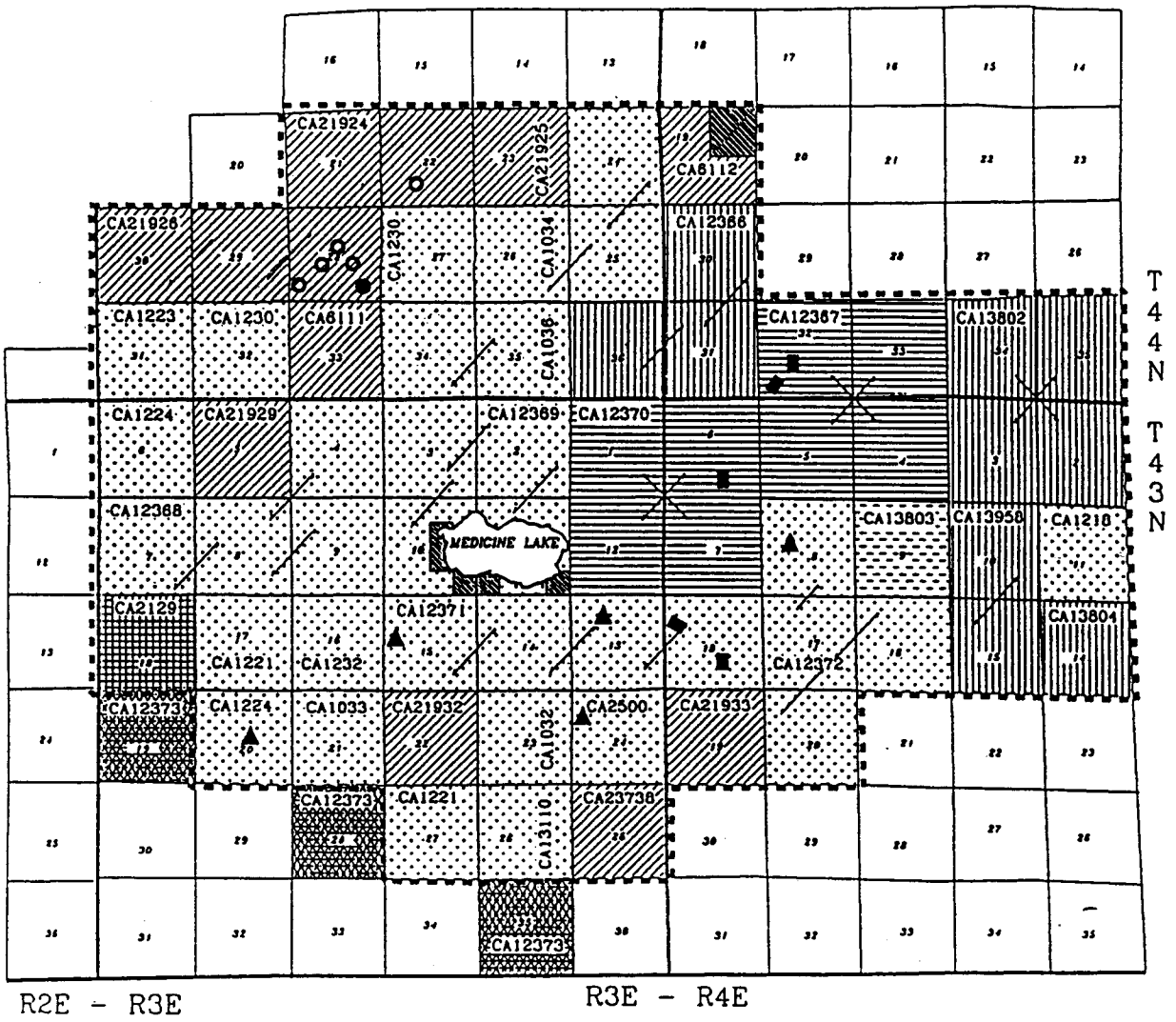
Calpine Fourmile Hill Exploration Program

Calpine Corporation has proposed a geothermal exploration program within the KGRA. Calpine Corporation, as the designated agent of Freeport-McMoRan Resource Partners (FMRP), proposed to drill 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, but are not 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 of TGH 88-28 in the fall of 1994. The TGH well pad measures approximately 75 feet by 100 feet. As the second phase of the exploration program, Calpine presented a proposal in the fall of 1994 to deepen TGH 88-28, and to conduct a deep exploration drilling program if the successful completion of TGH 88-28 confirms the presence of a heat source. Deepening of TGH 88-28 would take about 30 to 40 days, and would not require new surface disturbance.

The purpose of the proposed deep exploration program is to confirm the presence and extent of a commercial resource on the leases. In December of 1994, Calpine informed the BLM of its plans to submit a Plan of Operations for Exploration (POO) for the proposed exploration program, which would begin in June 1995. Although a formal POO has not been submitted, preliminary plans call for two deep exploration wells that could be drilled at any of six proposed locations proposed by Calpine. Figure 4.12-1 shows the six possible drilling locations. The deep test well program would require construction of two 2.5- to

Figure 4.12-1: Proposed Geothermal Projects in the Area



	CEGC 100%
	CEGC 50% FMRP 50%
	CEGC 25% FMRP 75%
	CEGC 62.5% FMRP 37.5%
	FMRP 100%
	CLJV
	Quadra Geo et al
	Fee—Unleased
---	Unit Boundary
CA 1221	Lease Numbers

- ▲ CEGC Proposed Core Holes
- ■ CEGC Proposed Exploration Wells
- o Calpine Proposed Drill Sites
- ● Calpine Existing Temperature Gradient Well

CEGC: California Energy General Corporation

FMRP: Freeport-McMoRan Resource Partners

CLJV: China Lake Joint Venture

N

0 1 2 3 4 MILES

SOURCE: CEGC 1994

GMU EA/IS

CALENDAR PAGE 638

MINUTE PAGE 002121

3.0-acre, single-well pads (although at least one of the pads would probably be an expanded TGH site). Drilling each of the two deep test wells would require about 45 days and would be followed by up to 30 days of testing. A new single-lane access road with turn-outs would be required to reach each pad site.

An environmental review of the Calpine proposal would be required prior to initiation of pad construction for deep drilling operations. Prior to drilling the initial well at TGH 88-28, Calpine contractors conducted archaeological and biological surveys of the areas proposed for surface disturbance in July 1994. The surveys covered surface areas of 4.5 acres at each of the six potential pad sites; this amount of area is well in excess of the expected deep test drilling pad size of three acres.

The successful completion and testing of the two deep test exploration wells is expected to yield the data necessary to confirm the production capabilities of the lease and allow the development of a geothermal power generation project of 30 megawatt (MW) capacity. Although the development of the 30 MW power plant is considered speculative at this time because a resource has yet to be defined on Leases CA-21926 and CA-21924, Calpine has conducted negotiations to sell power from the geothermal leases (for which Calpine is the designated agent) to the Bonneville Power Administration (BPA). The BLM would be required to prepare an Environmental Impact Statement (EIS) to analyze the environmental effects of any power development project, and the BPA would use the EIS to prepare a Record of Decision authorizing the contract to purchase the power from a new geothermal power plant at the Glass Mountain KGRA.

The above information on the Calpine project was provided by Calpine Corporation (Merrihew 1994).

OTHER PROJECTS

Tuscarora Gas Pipeline

This proposed gas pipeline is expected to begin construction in 1995 and be completed by 1996. This project would generate employment and job opportunities, similar to the proposed POO.

CUMULATIVE IMPACTS

Geology and Soils

The identified projects would add to the continuing alteration in the landscape due to construction of well pads and roads. These projects could slightly increase erosion in the Forests. The drilling and testing would add significantly to the information about the nature, extent, and character of the geothermal resource at the Glass Mountain KGRA. The identified projects would not result in significant cumulative effects to geology or soils.

Hydrology

The identified projects would result in cumulative water withdrawals from the groundwater system in the region. The water required for the proposed projects would be

withdrawn from more than one source, and would occur over a period of up to 4 years. The identified projects are not expected to result in cumulative impacts to surface or groundwater quality. The impact of the identified projects would not represent a significant cumulative effect on the hydrology of the area.

Cultural Resources

The proposed action would not affect cultural resources. None of the other cumulative projects have identified potential for effects to cultural resources; therefore there would be no cumulative effect to cultural resources in the region.

Native American groups have expressed concern about development in the Forests, including the proposed action. The proposed projects are dispersed and no cumulatively significant direct effects on Native American use of the Forests is expected.

Biology

The proposed action would result in the surface disturbance or grading of up to 29.6 acres, much of which has been previously disturbed by logging operations. Other proposed geothermal operations would also result in up to 7 acres of surface disturbance. This area serves as habitat for several wildlife species. This cumulative loss of habitat is not considered to represent a significant loss of habitat because of the abundance of similar habitat in the region. The cumulative loss of old growth trees from these projects would not be considered significant as very limited numbers of isolated old growth trees would be affected. The identified projects would not represent a significant cumulative effect on vegetation or wildlife.

Air Quality

Air emissions from identified projects would be short-term and temporary and would not be expected to represent a cumulative impact on air quality in the region. If the proposed action occurred at the same time as the Calpine Fourmile Hill exploration project, cumulative adverse air quality impacts would not be expected given the four-mile distance between the two projects and the ruggedness of the intervening topography.

Noise

The identified projects would intermittently add to the noise levels in the forests. The proposed project noise levels would be well below the standards identified in the GROs and would not cause significant cumulative impacts given the distance between the projects and the noise attenuation properties of the trees and intervening topography.

Visual Resources

The identified projects would add incrementally to visual disturbance of the tree line in the forest. The areas of disturbance for the proposed action are several miles from long-range view points and would be difficult to distinguish from the viewpoints. The contribution of the proposed action is considered minor because nine of the ten proposed well sites have been at least partially cleared of vegetation during previous logging

operations. The identified projects would add intermittent visual disturbance to long-range views during the time the drill rigs would be visible above the tree line and during testing period when a steam plume could be potentially visible above the tree line. These impacts would not be considered significant cumulative effects because of the limited and short-term nature of the visual intrusion, and the distance between the identified projects.

Land Use, Recreation, and Transportation Systems

Land Use: The proposed project is consistent with BLM and Forest plans and would not contribute to cumulative land use impacts in the region. Construction of facilities in the periphery of the Mount Hoffman Roadless Release Area (RRA) would not result in a significant cumulative effect as only 0.1% of the RRA would be affected.

Recreation: The identified projects would have only minor impacts on recreation in the area and would not result in significant cumulative impacts to recreation.

Transportation Systems: The proposed project would add 2,600 feet of new roads in the project vicinity to access pads 46-32 and 42-13TCH. New access roads would also be required for the two pads proposed in the Calpine project. These new roads would not be considered to represent a significant cumulative effect, given the extensive road network that exists in the forests to support timber harvest and recreation.

Socioeconomics

If the proposed Calpine Fourmile Hill geothermal exploration project occurred concurrent with the proposed action, the socioeconomic impacts would effectively double in 1995, as the two projects are similar and would have similar effects on employment and housing. Doubling of identified impacts combined with employment generated by the Tuscarora pipeline project would not be expected to result in significant cumulative effects.

4.13 Summary of Mitigation Measures

GEOLOGY AND SOILS

Mitigation Measure 4.2.1.

In order to protect the obsidian flow near pad 58-6, no facilities will be located within 200 feet of the toe of the obsidian flow. No surface disturbance or activity will occur between the edge of the pad and the toe of the obsidian flow.

Mitigation Measure 4.2.2.

Erosion controls (such as vegetated buffers and grass stabilization) will be used as prescribed by the USFS to protect surrounding undisturbed vegetation and down-slope areas. Erosion controls will stay in effect and be maintained until construction at the well pad site is completed or all of the cleared land at the well pad site is stabilized with new ground cover.

HYDROLOGY

Mitigation Measure 4.3.1

In order to verify that no effects are occurring at Paynes Springs from implementation of wells at well pads 56-18 and 13-18, CEGC will collect water samples from the springs before drilling, during initial drilling, after drilling to 500 feet (the equivalent elevation to the springs), and after completion of these wells. If effects are identified after analysis of the samples, drilling at these wells will be halted until the hydrologic connection to the springs is better understood. BLM and the USFS will compare the samples after they are analyzed.

CULTURAL RESOURCES

Mitigation Measure 4.4.1.

If archaeological resources are discovered during excavation for the proposed action, all work in the immediate vicinity will be suspended pending site investigation by the USFS and a qualified archaeologist to assess the materials and determine their significance. If the qualified professional determines that the resource will yield new information or important verification of previous findings, construction in the immediate area will not resume until the USFS and SHPO have been consulted and the resources appropriately evaluated and treated.

Mitigation Measure 4.4.2.

If prehistoric archaeological deposits that include human remains are discovered by the project sponsor or any construction contractors during excavation for the proposed action, the County Coroner will be immediately notified. If the remains are found to be Native American, local Native American groups and the Native American Heritage Commission (NAHC) will be notified within 24 hours. The most likely descendants of the deceased Native American will be notified and given the chance to make recommendations for the remains. If no recommendations are made within 24 hours, remains may be reinterred elsewhere on the property. If recommendations are made and not accepted, the NAHC will mediate the problem.

Mitigation Measure 4.4.3.

If archaeological resources are discovered during excavation for the proposed action and avoidance of these resources is not feasible, evaluation of the resources will be required. An evaluation plan will be prepared that provides for the methodical excavation of resources that would be adversely affected. Only a qualified archaeologist or cultural resources consultant will be allowed to collect any discovered prehistoric resources. The work will be accomplished within the context of a detailed research design and in accordance with current professional standards. The plan will result in the extraction of sufficient volumes of non-redundant archaeological data so as to address important regional research consideration, and detailed technical reports will be prepared to document the findings.

BIOLOGY

Mitigation Measure 4.5.1.

Conifers over 14 inches dbh will be avoided where feasible during pad construction. In addition, implementation of Mitigation Measure 4.2.2 will ensure that there would be no erosion effects to vegetation.

Mitigation Measure 4.5.2.

For the northern spotted owl, seasonal restrictions will be imposed by the USFS for all proposed well pad and access road locations. Under these restrictions, no construction or drilling may take place at the well pads between February 1 and August 15. For all well pads except for pad sites 63-20TCH and 15-15TCH, seasonal restrictions will be imposed until completion of protocol requirements (i.e., the second-year surveys). The second-year surveys will consist of site visits during the appropriate survey period. Upon completion of the surveys, one of two actions will be taken depending on the results of the surveys. If there are no owl responses, it will be determined that the proposed action would not have an effect on the owl, and the USFS will release the well pads from seasonal restrictions for owls. If there are owl responses, the USFS will require the seasonal restrictions as mitigation, and these restrictions will remain in place for those well pads that are in the vicinity of the responses.

The seasonal restrictions for pad sites 63-20TCH and 15-15TCH will remain in place for the life of the proposed action or until northern spotted owl protocol requirements are completed for these pads.

Mitigation Measure 4.5.3.

For the northern goshawk, seasonal restrictions will be imposed by the USFS for all proposed well pad and access road locations. Under these restrictions, no construction or drilling may take place at the well pads between February 1 and August 15. For all well pads except for pad sites 63-20TCH and 15-15TCH, seasonal restrictions will be imposed until completion of protocol requirements The goshawk surveys will consist of nesting surveys in May 1995. Upon completion of these surveys, one of two actions will be taken depending on the results of the surveys. If no goshawks or active goshawk nests are identified, it will be determined that the proposed action would not have an effect on the goshawk, the USFS will release the well pads from seasonal restrictions for goshawk, and the protocol would be deemed complete. If there are goshawk or active goshawk nests, the USFS will require that the seasonal restrictions be left in place until completion of the post-fledgling dependency period survey in early July through late August.

The results of the second surveys (if needed) will again result in one of two actions being taken. If there is no response during the second survey, it will be determined that the proposed action would not have an effect on the goshawk, and the seasonal restrictions for goshawk will be lifted. If goshawk presence is confirmed during the second survey, the USFS will require as mitigation that the seasonal restrictions remain in place for those well pads that are in the vicinity of the responses to avoid effects to goshawk.

The seasonal restrictions for pad sites 63-20TCH and 15-15TCH will remain in place for the life of the proposed action or until northern goshawk protocol requirements are completed for these pads.

Mitigation Measure 4.5.4.

For the American marten, CEGC will provide compensation mitigation for removal of marten habitat. Compensation mitigation will consist of placing d/d material from the well pads in concentrated debris piles near but somewhat isolated from the well pads, which will create denning sites for the marten. One to two piles per acre of disturbed marten habitat will be provided. Approximate minimum dimensions of the piles will be eight feet wide by four feet tall by 10 feet deep. The extent of compensation and the locations of mitigation sites would be determined by field surveys conducted by the USFS and CEGC prior to any construction activities at well pads.

Mitigation Measure 4.5.5.

Construction materials and equipment will arrive and leave all well pad sites by way of existing roads or through existing disturbed areas. Construction materials and equipment will not be allowed to cross areas that are to remain undisturbed. Construction materials and equipment will be stored within disturbed areas either at or near the well pad sites.

Mitigation Measure 4.5.6.

Where feasible, CEGC will top existing snags in adjacent areas to make these snags more suitable for use by wildlife species.

LAND USE, RECREATION, AND TRANSPORTATION SYSTEMS

Mitigation Measure 4.9.1.

All heavy vehicles associated with the proposed project (particularly water and other trucks accessing well pads 15-15TCH and 63-20TCH) will avoid using Road 43N48 in order to avoid potential damage to this road and to minimize the potential for conflicts between vehicles associated with the proposed action and recreational uses and motorists associated with the Medicine Lake campgrounds. Water for activities at these well sites will either be obtained from existing sources west of the well sites or trucked from the Arnica Sink wells on roads to the north of Road 43N48.

Mitigation Measure 4.9.2.

CEGC will submit design plans to Modoc County and the USFS for the intersection of the access road for pad 56-18 and PFR 97 to ensure that traffic at the intersection will not create a public safety hazard.

5: LIST OF PREPARERS AND AGENCIES AND PERSONS CONTACTED

5: LIST OF PREPARERS AND AGENCIES AND PERSONS CONTACTED

5.1 List of Preparers

This section lists those individuals who either prepared or participated in the preparation of this EA/IS.

LEAD AND SURFACE MANAGING AGENCIES

United States Department of Agriculture, Forest Service

Contributor	*Position*
Randall Sharp	Geologist/Project Coordinator USFS, Modoc National Forest
Gerry Gates	Archaeologist USFS, Modoc National Forest
Thomas Ratcliff	Wildlife Biologist USFS, Modoc National Forest
James Villegas	Wildlife Biologist USFS, Modoc National Forest

United States Bureau of Land Management

Contributor	*Position*
Joseph Wagner	Range Conservationist BLM, Susanville District Alturas Resource Area

United States Bureau of Land Management (continued)

Contributor	*Position*
Joseph McFarlan	Geologist BLM, Susanville District Surprise Resource Area

Siskiyou County Air Pollution Control District

Contributor	*Position*
Patrick Griffin	Air Pollution Control Specialist Siskiyou County APCD

CONSULTANT TEAM

This EA/IS was prepared for and under the direction of the lead and surface managing agencies by MHA Environmental Consulting, Inc. of San Mateo, California. The following staff contributed to this report:

MHA Environmental Consulting, Inc.

Contributor	*Position*
Laurie McClenahan	Principal
Hub Adams	Project Manager
Thomas Leaf	Senior Associate
Donelle Gregory	Associate

Subconsultants

Contributor	*Position*
Amy Gilreath	Archaeologist Far Western Anthropological Research Group, Inc.
David Smith	Biologist Wildlife Dynamics

5.2 Agencies and Persons Contacted

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

Contact	*Position/Affiliation*
Dan Breedon	Associate Planner Siskiyou County Planning Department
Frank Galea	Wildlife Biologist Galea Wildlife Consulting
John Heiser	Assistant Planner Modoc County Planning Department
Jerome S. Lukas, Ph.D.	Principal Consultants in Engineering Acoustics

Contact	*Position/Affiliation*
David McClain	Project Manager California Energy General Corporation
Ed Merrihew	Environmental Manager Calpine Corporation
Gretchen Taylor	Office Manager Alturas Chamber of Commerce
Betty Ward	Assistant Director Siskiyou County Visitor's Bureau

6: REFERENCES

6: REFERENCES

INTRODUCTION AND ALTERNATIVES, INCLUDING THE PROPOSED ACTION

BLM (U.S. Bureau of Land Management). 1994, *Environmental Assessment for Proposed Temperature Gradient Wells on Lease CA-21926*. 1994.

BLM and U.S. Department of Agriculture, Forest Service (USFS). 1981. *Geothermal Leasing of National Forest Lands in the Glass Mountain Known Geothermal Resource Area Supplemented Environmental Assessment*. 1981.

_____. 1984. *Geothermal Leasing of National Forest Lands in the Glass Mountain Known Geothermal Resource Area Supplemented Environmental Assessment*. September 1984.

_____. 1989. *Statewide Memorandum of Understanding for the Geothermal Program in California between the U.S. Forest Service, Region V and the Bureau of Land Management, California: Pre-lease and Post-lease Responsibilities and Actions.* November 1989.

CEGC (California Energy General Corporation). 1994. *Plan of Operations for Exploration Drilling, Glass Mountain Area, Siskiyou County, California*. May 1994.

USFS. 1991a. *Modoc National Forest Land and Resource Management Plan*. 1991.

_____. 1991b. *Modoc National Forest Land and Resource Management Plan Final Environmental Impact Statement*. 1991.

GEOLOGY AND SOILS

CEGC. 1994. *Plan of Operations for Exploration Drilling, Glass Mountain Area, Siskiyou County, California*. May 1994.

Colorado School of Mines. 1967. "Rocky Mountain Arsenal Well and the Denver (Derby) Earthquakes: A Progress Report." 1967.

U.S. Department of Agriculture, Forest Service and Soil Conservation Service. 1993. *Soil Survey of Modoc National Forest Area, California*. In cooperation with The Regents of the University of California (Agricultural Experiment Substation). 1993.

HYDROLOGY

CEGC. 1994. *Plan of Operations for Exploration Drilling, Glass Mountain Area, Siskiyou County, California.* May 1994.

McClain, David. 1994. Project Manager. California Energy General Corporation. Letter to Philip V. Woodward, Regional Water Quality Control Board, Central Valley Region. November 11, 1994.

USFS, BLM, and the Bonneville Power Administration. 1994. *Newberry Geothermal Pilot Project Draft Environmental Impact Statement.* January 1994.

U.S. Geological Survey (USGS). 1994. *Draft Hydrologic Monitoring Plan for the Glass Mountain Area*. December 1994.

CULTURAL RESOURCES

Cassidy, J. K. 1992. *Explaining Lithic Assemblage Differences in the Medicine Lake Highlands, Siskiyou County, California.* U.S. Department of Agriculture, Forest Service, Cultural Resources Management, 2360. 1992.

Far Western Archaeological Research Group, Inc. (Far Western). 1994. *Archaeological Survey Report: Inventory of Five Temperature Gradient Holes and Five Well Pads in the Glass Mountain Unit Area, Doublehead Ranger District of the Modoc National Forest, and McCloud District of the Shasta-Trinity National Forest, Siskiyou County, California.* November 4, 1994.

Hardesty, D. L., and S. Fox. 1974. *Archaeological Investigations in Northern California. Nevada Archaeological Survey Research Paper No. 4.* R. Elston and L. Sabini, eds., University of Nevada, Reno. 1974.

Henn, W. 1990. *Archaeological Research at Doe Peak, McCloud Ranger District, Shasta-Trinity National Forest.* Shasta-Trinity National Forest, Redding, CA. 1990.

Sundahl, E. 1985. *Archaeological Investigations at the Spattercone Site (F.S. 05-14-61-308) in the Medicine Lake Highlands Northeastern California.* Shasta-Trinity National Forest, Redding, CA. 1985.

BIOLOGY

Galea Wildlife Consulting. 1994. *Mount Hoffman Assessment Area Biological Data Collection: 1994 Progress Report for Calpine Corporation*. October 1994.

Galea, Frank. 1995. Wildlife Biologist. Galea Wildlife Consulting. Personal communucations. February and March 1995.

Guitiérrez, R.J., and Dames & Moore. 1993. *Biological Assessment for the Northern Spotted Owl, Unocal Glass Mountain Geothermal Project*. January 1993.

Ratcliff, Thomas. 1993-1995. Wildlife Biologist. USFS, Modoc National Forest. Personal communications. August 1993, May 1994, and February 1995.

Sanger, Allison L. 1995. Sensitive Plant Coordinator. USFS, Modoc National Forest. Personal communication to Dave Smith of Wildlife Dynamics. March 8, 1995.

Sharp, Randall. 1993-1995. Environmental/Appeals Coordinator. USFS, Modoc National Forest. Personal communications. August 1993, May 1994, and February 1995.

USFS and BLM. 1994a. *Final Supplemental Environmental Impact Statement on the Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (also known as "the President Plan" and "Option 9"). February 1994.

USFS, BLM, and the Bonneville Power Administration. 1994. *Newberry Geothermal Pilot Project Draft Environmental Impact Statement*. January 1994.

Villegas, James. 1994. Wildlife Biologist. USFS, Modoc National Forest. Personal communication. September 2, 1994.

Wildlife Dynamics. 1994. *Wildlife Habitat Assessment Report of Five Proposed Drill Pads and Five Temperature Core Holes for California Energy General Corporation*. November 1994.

AIR QUALITY

CARB (California Air Resources Board). 1991. *Emission Inventory 1989.* California Environmental Protection Agency: Air Resources Board, Technical Support Division, Emission Inventory Branch. 1991.

_____. 1992. *California Air Quality: Summary of 1991 Air Quality Data for Gaseous and Particulate Pollutants.* California Environmental Protection Agency: Air Resources Board, Technical Support Division. 1992.

USFS, BLM, and the Bonneville Power Administration. 1994. *Newberry Geothermal Pilot Project Draft Environmental Impact Statement*. January 1994.

NOISE

CEGC. 1994. *Plan of Operations for Exploration Drilling, Glass Mountain Area, Siskiyou County, California*. May 1994.

CIEA (Consultants in Engineering Acoustics). 1995. Letter report to MHA regarding noise octave and spectra for geothermal exploration activities. January 17, 1995.

Reeder, Harry C. 1986. *Report of Sound Level Survey Near Crater Lake for California Energy Company*. 1986.

LAND USE, RECREATION, AND TRANSPORTATION SYSTEMS

Sharp, Randall. 1994. Environmental/Appeals Coordinator. USFS, Modoc National Forest. Personal communication. August 24, 1994.

USFS. 1992. *Environmental Policy and Procedures Handbook*. September 21, 1992.

USFS and BLM. 1994a. *Final Supplemental Environmental Impact Statement on the Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl*. February 1994.

_____. 1994b. *Record of Decision and Standards and Guidelines for the Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl*. April 1994.

SOCIOECONOMICS

Breedon, Dan. 1994. Associate Planner. Siskiyou County Planning Department. Personal communication. December 1, 1994.

California Department of Finance. 1992. "Population and Housing Estimates of California Cities and Counties: Report E-5." Prepared by the Demographic Research Unit. April 29, 1992.

Heiser, John. 1994. Assistant Planner. Modoc County Planning Department. Personal communication. November 23, 1994.

Modoc County Planning Department. 1993. *Modoc County and City of Alturas General Plan Housing Element*. July 1993.

Sharp, Randall. 1994. Environmental/Appeals Coordinator. USFS, Modoc National Forest. Personal communication. December 2, 1994.

Taylor, Gretchen. 1994. Office Manager. Alturas Chamber of Commerce. Personal communication. November 23, 1994.

Ward, Betty. 1994. Assistant Director. Siskiyou County Visitor's Bureau. Personal communication. December 2, 1994.

CUMULATIVE IMPACTS

Merrihew, Ed. 1994. Environmental Manager. Calpine Corporation. Written communication. December 7, 1994.

APPENDIX A:
Initial Study Checklist

Initial Study Checklist

BACKGROUND INFORMATION

Title of Proposal:	Glass Mountain Unit Geothermal Exploration Project
Agency Requiring Checklist:	Siskiyou County Air Pollution Control District
	525 South Foothill Drive
	Yreka, California 96097
	(916) 842-8029
Agency Contact:	Pat Griffin, Air Pollution Control Specialist

DETERMINATION

On the basis of this initial evaluation:

a) I find that the proposed project *could not* have a significant effect on the environment, and

A NEGATIVE DECLARATION will be prepared. ☐

b) I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because the *mitigation* measures described on the attached sheets have been added to the project. Therefore,

A NEGATIVE DECLARATION will be prepared. ☐

c) I find that the proposed project *may* have a significant effect on the environment, and

An ENVIRONMENTAL IMPACT REPORT is required. ☐

Signature _____ Print Name _____

For _____ Date _____

Project Name: Glass Mountain Unit Geothermal Exploration Project

Project Location: Glass Mountain Known Geothermal Resource Area, Modoc and Shasta-Trinity National Forests, Siskiyou County

Description of Project: Plan of Operations for drilling of up to five geothermal temperature core holes, and drilling deep geothermal exploration wells at five well pads.

ENVIRONMENTAL IMPACTS

	YES	MAYBE	NO
1. Earth. Will the proposal result in:			
a. Unstable earth conditions or changes in geologic substructures?			x
b. Disruption, displacement, compaction, or overcovering of the soil?	x		
c. Change in topography or ground surface relief features?	x		
d. The destruction, covering, or modification of any unique geologic or physical features?			x
e. Any increase in wind or water erosion of soils, either on or off the site?	x		
f. Changes in deposition or erosion of beach sands, or changes in siltation, deposition or erosion which may modify the channel of a river or stream or the bed of the ocean of any bay, inlet or lake?			x
g. The exposure of people, structures, or property to geological hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?		x	
2. Air. Will the proposal result in:			
a. Substantial air emissions or deterioration of ambient air quality?			x
b. The creation of objectionable odors?		x	
c. Alteration of air movement, moisture, or temperature, or any change in climate, either locally or regionally?			x
3. Water. Will the proposal result in:			
a. Changes in currents, or the course of direction of water movements, in either marine or fresh waters?			x
b. Changes in absorption rates, drainage patterns, or the rate and amount of surface runoff?	x		
c. Alteration to the course or flow of flood waters?			x
d. Changes in the amount of surface water in any water body?			x

	YES	MAYBE	NO
e. Discharge into surface waters, or in any alteration of surface water quality, including, but not limited to, temperature, dissolved oxygen, or turbidity?			X
f. Alteration of the direction or rate of flow of ground waters?		X	
g. Change in the quantity or quality of ground waters, either through direct additions or withdrawals, or through interception of an aquifer by cuts or excavation?		X	
h. Substantial reduction in the amount of water otherwise available for public water supplies?			X
i. Exposure of people or property to water-related hazards such as flooding or tidal waves?			X
4. Plant Life. Will the proposal result in:			
a. Change in the diversity of species, or in the number of any species of plants (including trees, shrubs, grass, crops, and aquatic plants)?			X
b. Reduction in the numbers of any unique, rare, or endangered species of plants?			X
c. Introduction of new species of plants into an area, or in a barrier to the normal replenishment of existing species?			X
d. Reduction in acreage of any agricultural crop?			X
5. Animal Life. Will the proposal result in:			
a. Change in the diversity of species, or in the number of any species of animals (birds, land animals including reptiles, fish and shellfish, benthic organisms or insects)?			X
b. Reduction in the numbers of any unique, rare, or endangered species of animals?			X
c. Introduction of new species of animals into an area, or in a barrier to the migration or movement of animals?			X
d. Deterioration to existing fish or wildlife habitats?		X	
6. Noise. Will the proposal result in:			
a. Increases in existing noise levels?	X		
b. Exposure of people or noise-sensitive receptors to severe noise levels?			X

	YES	MAYBE	NO
7. Light and Glare. Will the proposal result in:			
a. A new substantial source of light or glare?			x
8. Land Use. Will the proposal result in:			
a. Substantial alteration of the present or planned land use of an area?			x
9. Natural Resources. Will the proposal result in:			
a. Any increase in the rate of use of any natural resources?			x
10. Risk of Upset. Will the proposal involve:			
a. A risk of an explosion or the release of hazardous substances (including, but not limited to: oil, pesticides, chemicals, or radiation) in the event of an accident or upset conditions?		x	
b. Possible interference with an emergency response plan or an emergency evacuation plan?			x
11. Population. Will the proposal:			
a. Alter the location, distribution, density, or growth rate of the human population of an area?			x
12. Housing. Will the proposal:			
a. Affect existing housing, or create a demand for additional housing?			x
13. Transportation/Circulation. Will the proposal result in:			
a. The generation of substantial additional vehicular movement?			x
b. Effects on existing parking facilities, or demand for new parking?			x
c. A substantial impact upon existing transportation systems?			x
d. Alterations to present patterns of circulation or movement of people and/or goods?			x
e. Alteration to waterborne, rail or air traffic?			x
f. Increase in traffic hazards to motor vehicles, bicyclists, or pedestrians?			x
14. Public Services. Will the proposal have an effect upon, or result in a need for new or altered governmental services in any of the following areas:			
a. Fire protection?			x

	YES	MAYBE	NO
b. Police protection?			x
c. Schools?			x
d. Parks or other recreational facilities?			x
e. Maintenance of public facilities, including roads?		x	
f. Other governmental services?			x
15. Energy. Will the proposal result in:			
a. Use of substantial amounts of fuel or energy?			x
b. Substantially increased demand upon existing sources of energy, or require the development of new sources of energy?			x
16. Utilities and Service Systems. Will the proposal result in a need for new systems, or substantial alterations to the following utilities:			
a. Electrical power or natural gas?			x
b. Communications systems?			x
c. Water?			x
d. Sewer or septic tanks?			x
e. Storm water drainage?			x
f. Solid waste and disposal?			x
17. Human Health. Will the proposal result in:			
a. Creation of any health hazard or potential health hazard (excluding mental health)?		x	
b. Exposure of people to potential health hazards?		x	
18. Aesthetics. Will the proposal result in:			
a. The obstruction of any scenic vista or view open to the public?			x
b. The creation of an aesthetically offensive site open to public view?			x
19. Recreation. Will the proposal result in:			
a. An impact upon the quality or quantity of existing recreational opportunities?			x

	YES	MAYBE	NO
20. Cultural Resources. Will the proposal:			
a. Result in the alteration or destruction of a prehistoric or historic archaeological site?			X
b. Result in adverse physical or aesthetic effects to a prehistoric or historic building, structure, or object?			X
c. Have the potential to cause a physical change that would affect unique ethnic cultural values?		X	
d. Restrict existing religious or sacred uses within the potential impact area?		X	
21. Mandatory Findings of Significance.			
a. **Potential to Degrade:** Does the proposal have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?			X
b. **Short-term:** Does the proposal have the potential to achieve short-term, to the disadvantage of long-term, environmental goals? (A short-term impact on the environment is one which occurs in a relatively brief, definitive period of time, while long-term impacts will endure well into the future.)			X
c. **Cumulative:** Does the proposal have impacts which are individually limited, but cumulatively considerable? (A project may impact on two or more separate resources where the impact on each resource is relatively small, but where the effect of the total of those impacts on the environment is significant.)			X
d. **Substantially Adverse:** Does the proposal have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?			X

APPENDIX B:
Public Scoping Letters

Medicine Lake Geot[illegible]al Activities
Glass Moun[illegible]in KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

John Aquila
214 Shasta Ave.
Mt. Shasta, CA 96067

___ **I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.**

__X__ **Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.**

___ **I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.**

__X__ **I have the following specific comments regarding the geothermal proposal:**

1. I do not want to have any major geothermal development within the Medicine Lake basin.

2. I do not feel it is necessary to clear 5 acres of land to build a well pad. I think one acre would be sufficient and ½ acre would be even more appropriate.

3. I am very concerned that excessive drilling within the basin could lower the water level of the lake itself. One of the proposed sites, 42-13TCH, would only be 3/4 mile from the lake. That is too close.

Signed: John Aquila

CALENDAR PAGE	662
MINUTE PAGE	002145

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

PHILLIP BATTAGLIA
W.M. Beaty and Associates
[illegible]
[illegible], CA 95009

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

X Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: _____

CALENDAR PAGE	663
MINUTE PAGE	002146

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Betty Belchar (deceased)
c/o Joan A. Belchar
14857 Bancroft Ave. #6
San Leandro, CA 94578

(SEE NAMES OF NEW PROPERTY OWNERS BELOW)

___ **I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.**

_X_ **Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.**

___ **I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.**

___ **I have the following specific comments regarding the geothermal proposal:**

Further communications should be addressed to the following:

Joan A. Belchar
14857 Bancroft Ave., #6; San Leandro, CA 94578

Richard J. Belchar
1843 Silverwood Dr.; Concord, CA 94521

Linda L. Lopes
18849 Sandy Rd., Castro Valley, CA 94546

Signed: Joan A. Belchar

CALENDAR PAGE	664
MINUTE PAGE	002147

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Marian Blakeney
P.O. Box 175
Dorris, CA 96023

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

___ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA

___ I have the following specific comments regarding the geothermal proposal:

Signed: _____

CALENDAR PAGE	665
MINUTE PAGE	002148

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Ralph Bowman
Box 1556
Alturas CA. 96101

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

✓ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: _____

CALENDAR PAGE	666
MINUTE PAGE	002149

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Paul Brewer
Box 262
Burney, CA 96013

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

X Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: Paul A Brewer

CALENDAR PAGE	667
MINUTE PAGE	002150

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Butte Valley Chamber of Commerce
Box 541
Dorris, CA 96023

↘ ___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

↘ ___ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

↘ ___ I have the following specific comments regarding the geothermal proposal:

WOULD YOU PROVIDE THE CHAMBER WITH MORE INFORMATION ABOUT CE GENERAL CORP. SUCH AS, WHERE ARE THEIR HEADQUARTERS LOCATED, WHO ARE THE CORPORATIONS OFFICERS, IS IT A PUBLICLY HELD CORPORATION, ETC..

PLEASE ADD TO YOUR MAILING LIST.

1. MT. SHASTA CHAMBER OF COMMERCE
   300 PINE ST.
   MT. SHASTA, CA. 96097

2. BUTTE VALLEY RCD
   P.O. BOX 785
   DORRIS, CA. 96023

Signed: [signature], PRESIDENT

CALENDAR PAGE	668
MINUTE PAGE	002151

BUTTE VALLEY CHAMBER OF COMMERCE

BOX 541, DORRIS, CALIFORNIA 96023

October 10, 1994

U. S. Forest Service
MODOC National Forest
800 West 12th Street
Alturas, Ca. 96101-3132

Ref: Plan of Operation (POO) for geothermal exploration in the Medicine Lake Area

Attn: Randall Sharp

The Butte Valley Chamber of Commerce has by unamious vote directed me to request that a formal public hearing be held regarding the subject POO.

The information packet which you provided to us raised more questions than it answered. We believe that the only way to understand this proposal in sufficient depth is an open public meeting with questions and answers.

We would suggest that the meeting be held at a time and place in Butte Valley which would afford local residents the best opportunity to participate in a meaningful exchange of information and comments.

Sincerely,

J. K. Covington, President

cc: Jim Stout, Klamath National Forest
File

CALENDAR PAGE	669
MINUTE PAGE	002152

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

California Depart. of Fish and Game
Attn: Tim Burton
1724 Ball Mtn. Rd
Montague, CA 96064

✓ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

✓ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: T Burton

CALENDAR PAGE	670
MINUTE PAGE	002153

California Wilderness Coalition

2655 Portage Bay East, Suite 5 • Davis, California 95616 • (916) 758-0380

February 7, 1995

Randall Sharp
Modoc National Forest
800 West 12th. Street
Alturas, CA 96101

Dear Mr. Sharp:

Please place us on the mailing lists for the following projects so that we may submit scoping comments when the time comes:

--Pack Station SUP
--Geothermal Exploration Activities
--Tuscarora Gas Line EIS

Thank you for your help.

Sincerely,

Ryan Henson
Conservation Associate

CALENDAR PAGE	671
MINUTE PAGE	002154

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

CE Exploration Company
Attn: Dave McClain
34 N.W. First Ave., Suite 302
Portlan, OR 96088

/ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

X Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: D W McClain

CALENDAR PAGE	672
MINUTE PAGE	002155

Medicine Lake Geoth[illegible] ivities
Glass Mountain .

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Central Valley Water Quality Board
415 Knollcrest, Suite 100
Redding, CA 96002

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

X Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: Mark Henry

CALENDAR PAGE	673
MINUTE PAGE	002156

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Cottonwood Enterprises
Box 456
Cottonwood, CA 96022

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

XXXX Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

XXXX I have the following specific comments regarding the geothermal proposal:

We are concerned what their heavy equipment will do to the roads and who will be responsible for the repairs.

We have had very low water level in Medcine Lake for several years. We fear their drillingis taping in to the water supply that feeds the Lake.. Do you know if this is true?

We are concerned about the proposed sights nearest to Medcine Lake and the Private Cabin Area.

We do not like the idea of claearing off five acre parcels of land to set up these drilling rigs. We hope you have our concern in mind environmentaly to keep our area as beautiful as possible. We bought here because it was a natural and lovely place for our children.

If they continue to work up in the area during the winter, will the road to Medcine Lake be maintained so we can travel through the winter?

Signed: Gene Boor
Theresa Nichols Cottonwood Ent.
Warren D Nichols

CALENDAR PAGE	674
MINUTE PAGE	002157

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Glen Darrow
Rt 2 Box 172
Tulelake, CA 96134

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

yes Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

yes I have the following specific comments regarding the geothermal proposal:

I am for Medicine Lake Geothermal activities

Signed: Glen E. Darrow

CALENDAR PAGE	675
MINUTE PAGE	002158

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Daniel Downey
220 Main St.
Montesano, WA 98563

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

__X__ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: Daniel G. Downey 9-26-94

CALENDAR PAGE	676
MINUTE PAGE	002159

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Phillip/MARINA
~~Robert~~ Facchin
1321 Mott Road
Mt. Shasta, CA 96067

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

✓ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: Phillip R Facchin

CALENDAR PAGE	677
MINUTE PAGE	00·2160

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

George Faggella
1025 Deodar Way
Redding, CA 96003

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

✓ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: George A. Faggella

CALENDAR PAGE	678
MINUTE PAGE	002161

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Betty Faist
1216 Cedarbrook Way
Sacramento, CA 95831

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

_X_ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: _____

CALENDAR PAGE 679
MINUTE PAGE 002162

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Fruit Growers Supply Co.
Fruit Growers Road
Hilt, CA 96044

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

X Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: Charles Brown

CALENDAR PAGE	680
MINUTE PAGE	002163

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Glass Mountain Pumice
Star Route Box 6
Tulelake, CA 96134

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

X Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

We are interested in the project and would like to provide service/aggregate if possible.
Thank you,

Signed: [signature]

CALENDAR PAGE	681
MINUTE PAGE	002164

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Niilo Hyytinen
13290 Hodge Drive
Reno, NV 89502

✓ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

✓ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: Niilo M. Hyytinen

CALENDAR PAGE	682
MINUTE PAGE	002165

Nr. Randall Sharp
Modoc National Forest
800 W. 12th St
Alturas, Ca 96101

Nov. 1, 1994

Dear Mr. Sharp;

I am concerned about the geothermal generating facility proposed for the Medecine Lake Highlands area, and would like to make the following comments at this time.

I feel a first phase of exploration could be accomplished with fewer test borings. The large number of sites currently proposed will have a significant negative impact on the environment with no offsetting benefit should the results be discouraging to further development.

The roads required to access the test hole sites should be limited in length and number, and should be obliterated where possible.

If not sited properly, a generating facility could be a blight on this pristine area. The value of proper planning to preserve scenic and recreation resources cannot be overemphasized. The future economic growth of Modoc County depends on the ability to attract tourists, which in turn depends on our commitment to protecting the natural scenic beauty with which we are favored.

I am particularly concerned about the grid of transmission lines that would be necessary to connect wells at dispersed locations.

Geothermal energy is not an unlimited resource; in fact, the Geysers in California demonstrated how quickly it can be exhausted. The long term economic potential of preserving recreational opportunity should not be sacrificed for short-term energy extraction.

Please put me on the mailing list to receive information on this proposed project.

Thank you,

Sandy Ivey
731 Miner Rd
Orinda, Ca 94563
(510)254-7471

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Frances Jones
1655 Manitoba Dr.
Sunnyvale, CA 94087

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

__X__ Please include my (~~our~~) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: Frances Jones

CALENDAR PAGE	684
MINUTE PAGE	002167

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Pete Lorenzen + Laurel
Day Route
Mc Arthur, CA 96056

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

✓ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

✓ I have the following specific comments regarding the geothermal proposal:

M. Lake level is way down & continues to stay down even after our wet year in 92-93. Some people ourselves included wonder - does the drilling in our area contribute to this - It would be ok to leave our Mountain area alone - every square inch of earth does not have to be explored & exploited - It would be ok to leave something for children - grandchildren to enjoy -

Signed: Laurel Lorenzen 10-3-94

336-5843

CALENDAR PAGE	685
MINUTE PAGE	002168

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

James McEntee
Box 442
McCloud, CA 96057

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

X Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: J. McEntee

CALENDAR PAGE	686
MINUTE PAGE	002169

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Robert Medley
910 Sierra Vista
Redding, CA 96001

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

X Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: Robert M. Medley

CALENDAR PAGE	687
MINUTE PAGE	002170

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Mark Merrithew
1010 Mountain View Lane
Mt. Shasta, CA 96067

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

X Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

X I have the following specific comments regarding the geothermal proposal:

1. Ive read that geothermal operations create poisonous gases?
   A. HAS A study of the hazards been done?
   B what about fluctuating winds?
   C. why should I even be put at risk?
2. the operation would be extremely noisy?
   A. HAS A decibel evaluation been surveyed?
   B. Consider noise pollution
3. HAS an environmental impact study been taken?
   A. Natural sites would be distrubed
   B. was there any surveys taken before exploratory?
   C. Should have had a before & after report
4. How will these wells affect the value of my property?
5. How will this affect the Medicine Lake Camp ground?

Signed: Mark Merrithew

CALENDAR PAGE	688
MINUTE PAGE	002171

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Paul Molder
Star Route. Box 7
Tulelake, CA 96134

/ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

/ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: Paul J. Molder

CALENDAR PAGE	689
MINUTE PAGE	002172

Randall Sharp
Modoc National Forest
800West 12th St.
Alturas , Ca. 96101

Dear Mr. Sharp:

As a member of the local community living at Tionesta which is approximately 17 miles to the south -east of the effected area of the proposed plan of operation I do have some concerns.

I would like to make it clear at this time that I am not totally against this plan but have some grave concerns over the final outcome of this operation. I like the idea of using the majority of the sites for the temperature gradient holes on previously disturbed areas and using existing roads . I do not like the idea of clearing five acre per site for the larger drill rigs. I watched the drilling that UNICAL did with the second largest drill rig they had at the time and I feel that five areas is a figure which may make life a little easier for CEGC, but they could operate with less then five acres of land. You have to remember after they pull out and are totally forgotten the scars on the land will be left for many decades. You mention that land will need to be cleared for these sites. I only hope that the destruction of the land be kept to a minimum and that what ever trees need to be removed are part of the firewood cutting program and not dozed into piles and burned like I have seen in the past such as at that waste of land and money radar site.

I feel ultimately this will lead to the development of one or more power plants which means the destruction of more and more land with plant sites and all of the transmission lines that go with it . I have concerns on what kind of effect it will have on the aquifer and what effects it may have on the local geology. I have read quite a few reports from USGS and have talked to a few of the geologists and know this is still a quite active volcanic area in which they still are not sure of what is going on. Other concerns are what impact will this have on the local community. I know that some of the locals think that this will bring in more jobs. I feel that the local community will be quite disappointed. Working in the utilities myself I know that the majority of the jobs will be given to people already employed with the utility. These people will be transferred in from other areas. The few jobs that will be available to the locals will for the most part be low paying menial jobs. As for the local businesses, the amount of extra income will be minimal for most utilities do all their buying through vendors which offer them better service and prices then local business can.

Finally after reviewing some data from the PG&E plant in the Napa Valley I hope that before any power plants are installed that the BLM will be very sure that this will be a power resource that will last for many decades to come. It would be a real crime to destroy such pristine beauty that can not be replaced in my life time nor my young daughters' life time and in all probability in her children's' lifetime because of a short sited plan.

I will keep a keen interest on what is going on and hope you will keep me informed on any future activities.

Sincerely yours

Paul J. Molder

Paul J. Molder
Star Route, Box 7
Tulelake, Ca. 96134

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Charles Moss
201 W. Lake St.
Mt. Shasta, CA 96067

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

✓ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

✓ I have the following specific comments regarding the geothermal proposal:

Please be careful not to alter the water in Medicine Lake.

Signed: Charles F Moss

CALENDAR PAGE	692
MINUTE PAGE	002175

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Edward Motmans
c/o Christina F. Keefer
14045 Hill Rd.
Klamath Falls, OR 97603

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

✓ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: [signature]

4/94

CALENDAR PAGE	693
MINUTE PAGE	002176

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Harold Neibling
~~2700 Bellflower Blv. Suite~~ 301
~~Long Beach, CA 90815.~~
350 Engine Landing
Long Beach Ca 90803

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

X Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

X I have the following specific comments regarding the geothermal proposal:

The Geothermal Wells are Ok if: (1) They dont drain Water from the Medicine Lake Table (2) Roads are kept clean. (3) Drilling operation doesn't create undue Smog or noise pollution in the areas.

Thanks!

DR Signed: H E Neibling

Change Mail

350 Engine Landing
Long Beach Ca 90803
(310) 498-2993

#1 Beach St
~~Medicine Lake~~
Cabin

CALENDAR PAGE	694
MINUTE PAGE	002177

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

X Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Claude E. Olson
1536 N. Eldorado Ave.
Klamath Falls, OR
97601

Signed: Claude Olson

CALENDAR PAGE	695
MINUTE PAGE	002178

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Felic Pace
Klamath Forest Alliance
P.O. Box 820
Etna, CA 96027

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

✓ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

We want to review the EA.

TX

EP

Signed: Felic Pace

CALENDAR PAGE	696
MINUTE PAGE	002179

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Darrel Roe
1002 Hillside Dr.
Weed, CA 96094

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

_X_ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: _____

Mr. Darrel Roe
849 N. Township Rd
Mt. Shasta City, CA 96...

CALENDAR PAGE 697
MINUTE PAGE 002180

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Robert Scott
711 South St.
Yreka, CA 96097

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

X Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: Robert Scott

CALENDAR PAGE	698
MINUTE PAGE	002181

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Sierra Club/Shasta Group
Attn: CArl Weidart
30646 100 Road
Singleton, CA 96088

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

___ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed:_____

CALENDAR PAGE	699
MINUTE PAGE	002182

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

George Setzer
Tionesta
Tulelake, CA 96134

✓ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

✓ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: _____

CALENDAR PAGE	700
MINUTE PAGE	002183

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Harry Shott
300 Sheldon Ave.
Mt. Shasta, CA 96067

✓ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

✓ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: Harry - Louise Shott

CALENDAR PAGE	701
MINUTE PAGE	002184

October 12, 1994

Randall Sharp;
Modoc National Forest
800 West 12th Street
Alturas, Ca. 96101

Mr. Sharp;

We are writing in regard to the Geothermal Exploration Activities in the Medicine Lake area.

There has been quite a lot of exploration already done in this area. There are two sites that we object to. They are to close to the Medicine Lake subdivision. They are #15-15 TCH and #42-13 TCH. From past drillings , the noise alone will be objectionable. Being in the Mountains, noise carries over a large area. Especially at night.

We go to Medicine Lake for the peace and quiet. We hope this will be taken into considertion.

Thank you

Bettie Shott

Harry A. Shott

Bettie and Harry Shott
300 Sheldon Ave
Mt. Shasta, Ca. 96067

CALENDAR PAGE	702
MINUTE PAGE	002185

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Lorin Spencer
1894 N. Euclid Ave.
Upland, CA 91786

X I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

X Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

__ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

__ I have the following specific comments regarding the geothermal proposal:

Daniel T. Spencer
696 - 18th Street #2
Des Moines, IA 50314

Dan is my son - as a geologist he worked with USGS several years ago mapping volcanic activity in the Medicine Lake Highlands.

Amanda L. Spencer
1800 Lincoln Village Circle Drive Apt. 2324
Larkspur, Ca 94939

Amanda is my daughter - a registered geologist and a hydrologic engineer whose master's thesis at UC-Berke[ley] dealt with a study of underground hot areas in Iceland.

Signed: Lorin Spencer

I have sent copies of this material to each of them for their comment. My [illegible] is that the well sites appear dangerously close to re[illegible] areas [illegible] Medicine Lake - Lorin Spencer

CALENDAR PAGE 703
MINUTE PAGE 002186

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Sidney ~~Edward~~ Staunton
Route 1 Box 296,
Tulelake, CA 96134

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

✓ Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: _____

CALENDAR PAGE	704
MINUTE PAGE	002187

Modoc Natl Forest - Attn: Randall Sharp ——— Oct 6, 1994
800 W. 12th Street
Alturas, Ca. 96101

I have the following comments on the geothermal proposal I have had a cabin at Medicine Lake for 34 years and spend much of the summer there with friends and relatives. We are attracted there by the quiet and uncrowded condition of the terrain.

I notice on your map that wells # 13 + 15 are within one mile of the lake and cabin area. The noise associated with drilling + maintaining these wells would impact on the serenity of this mountain retreat. Also, the construction of roads and the clear cutting attendant upon the building of a pad to make use of the geo-thermal power will greatly disturb the recreation value of this area.

I have watched the drilling of many wells in this area. Several are capped for further use. Why drill more? If more wells must be drilled, please consider eliminating sites # 13 + 15 from the plan.

I was shown this proposal by Harry Shatt, a neighbor at the Lake cabin. Please send me a copy of this proposal and include my name on all future mailing lists for this project or similar activities within the Glass Mtn KGRA.

CALENDAR PAGE 705
MINUTE PAGE 002188

Thank you.

Sincerely yours

Louise Thompson
1235 W. Scenic Dr,
Mt Shasta, Ca 96067

MS LOUISE THOMPSON
1235 W SCENIC DR
MOUNT SHASTA CA 96067

Also - Please add to the mailing list for this project - Send her the current geothermal proposal

Olga Orr
7470 Seneca Place
La Mesa, Ca 91941

She too has a cabin at Medicine Lake

CALENDAR PAGE	706
MINUTE PAGE	002189

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

~~Peggy Maxwell~~
~~1209 W. 11th St.~~
~~Alturas, CA 96101~~

Mr. & Mrs. Ron Turek
417 Marin St.
Corning
Calif. 96021

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

✓ Please include ~~my~~ (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: Peggy Maxwell

CALENDAR PAGE	707
MINUTE PAGE	002190

Medicine Lake Geotherma_ Act_vities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Ethel Tygerson
1509 Seacrest Lane
Brookings, OR 97415

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

X Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: Ethel Tygerson Krause

CALENDAR PAGE	708
MINUTE PAGE	002191

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

W.H. Weitkamp
251 James Way
Arroya Grande, CA 96067

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

X Please include my (our) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: W. H. Weitkamp

CALENDAR PAGE	709
MINUTE PAGE	002192

Medicine Lake Geothermal Activities
Glass Mountain KGRA

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Vivian Wells
6324 Shasta Way
Klamath Falls, OR 97603

___ I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

___ Please include my (~~our~~) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

___ I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

___ I have the following specific comments regarding the geothermal proposal:

Signed: Vivian Wells

CALENDAR PAGE	710
MINUTE PAGE	002193

County of Modoc
Department of Public Works
202 W. 4th Street
Alturas, California 96101
(916) 233-6403 office
(916) 233-3132 FAX

JOHN G. PEDERSEN
Director/Road Commissioner
MICHAEL L. MACDONALD
Deputy Road Commissioner
RICHARD R. HIRONYMOUS
Deputy Director Public Works
MICHAEL KIP LYBARGER
County Surveyor

January 31, 1995

Randall Sharp
Modoc National Forest
800 West 12th Street
Alturas CA. 96101

Dear Mr. Sharp:

The Modoc County Road Department has reviewed the California Energy General Corporation Glass Mountain Geothermal Exploration Projects Environmental Assessment/Initial Study and on the basis of the information provided in said document we offer the following comments:

1. Prior to pad access roads being constructed from any roads in the County Maintained system an encroachment permit is required.

2. County road 97, in the vicinity of the proposed project, is near the end of its design life and will not accommodate heavy traffic such as water or logging trucks. Our concern is that heavy loads could break up and destroy the pavement along this road. Prior to the use of this road California Energy General Corporation needs to propose a method of mitigating any potential damage.

Encroachment permits are available at the Modoc County Road Department office, 202 West 4th Street, Alturas,CA 96101.

If you have any questions regarding the comments, please call Mike Macdonald at (916) 233 6411.

Sincerely,

Michael L Macdonald

Michael L. Macdonald
Deputy Road Commissioner

MLM:mlm

cc: D. McCellon
Herb Adams

CALENDAR PAGE	711
MINUTE PAGE	002194

APPENDIX C: Mitigation Monitoring and Reporting Program

APPENDIX C: Mitigation Monitoring and Reporting Program

This Mitigation Monitoring and Reporting Program (MMRP) outlines procedures for the implementation of mitigation measures identified in this Environmental Assessment/ Initial Study (EA/IS) to reduce all potential environmental effects of the proposed action to less-than-significant levels. California Energy General Corporation (CEGC) and its construction contractors must fully comply with the conditions and measures described in this MMRP. The U.S. Forest Service (USFS) will monitor and verify compliance with the MMRP and will be responsible for preparing brief compliance reports that will be kept on file by the USFS, U.S. Bureau of Land Management (BLM), and Siskiyou County Air Pollution Control District (SCAPCD).

The MMRP is organized in table format and is keyed to each mitigation measure identified in the EA/IS. The MMRP is organized by environmental issue area, and discusses only those impacts for which mitigation has been identified. The intent of formatting the MMRP as a table is to provide the reader with a concise and quick summary of the measure(s) to be implemented, agencies involved, timing of implementation, and frequency of monitoring. The purpose of each column heading is as follows:

- **Mitigation Measure:** A summary of the mitigation requirement;
- **Implementation Procedure:** Additional information on how mitigation measures will be implemented, where needed;
- **Monitoring and Reporting Actions:** An outline of the appropriate monitoring and/or reporting actions required to verify implementation of measures;
- **Responsible Agency:** The responsible agency will be responsible for monitoring the implementation of all mitigation measures identified in the MMRP. Other agencies which will be involved with the review and approval of actions required to implement specified mitigation measures and reporting tasks are identified, as appropriate; and
- **Monitoring Schedule:** A schedule for conducting each mitigation monitoring and reporting action.

The full text of the EA/IS mitigation measures is contained under the appropriate parameter discussion in Chapter 4 of this EA/IS.

Mitigation Monitoring and Reporting Program

GEOLOGY AND SOILS

MITIGATION MEASURE	IMPLEMENTATION PROCEDURE	MONITORING AND REPORTING ACTIONS	RESPONSIBLE AGENCY	MONITORING SCHEDULE
4.2.1 In order to protect the obsidian flow near pad 58-6, no facilities will be located within 200 feet of the toe of the obsidian flow. No surface disturbance or activity will occur between the edge of the pad and the toe of the obsidian flow.	CEGC will stake the limits of construction at pad 58-6 to be a minimum of 200 feet from the obsidian flow. CEGC will construct the pad so that no facilities will be located within 200 feet of the obsidian flow, and no surface disturbance or activity will occur between the edge of the pad and the toe of the obsidian flow.	1) Review pad construction drawings for pad 58-6 and inspect staking and pad during construction to ensure no facilities are located within 200 feet of the obsidian flow. 2) Inspect pad during drilling and testing activities to ensure no surface disturbance or activity has occurred between the edge of the pad and the toe of the obsidian flow.	USFS	1) Review construction drawings prior to commencement of construction, and inspect pad after pad is staked and before construction is commenced. 2) Inspect pad once during drilling activities, and once every four months during testing activities.
4.2.2 Erosion controls (such as vegetated buffers and grass stabilization) will be used as prescribed by the USFS to protect surrounding undisturbed vegetation and down-slope areas. Erosion controls will stay in effect and be maintained until construction at the well pad site is completed or all of the cleared land at the well pad site is stabilized with new ground cover.	CEGC will implement and maintain erosion controls as prescribed by the USFS.	1) Inspect pad sites prior to construction to identify pads where erosion controls would be necessary. 2) Inspect the pad sites that have had erosion control implemented to verify that erosion controls have been properly maintained.	USFS	1) Inspect each pad site prior to construction at the pad site to identify necessary erosion controls. 2) Inspect the pad sites with implemented erosion controls once during construction and once during drilling to verify erosion control maintenance.

HYDROLOGY

MITIGATION MEASURE	IMPLEMENTATION PROCEDURE	MONITORING AND REPORTING ACTIONS	RESPONSIBLE AGENCY	MONITORING SCHEDULE
4.3.1 In order to verify that no effects are occurring at Paynes Springs from implementation of wells at well pads 56-18 and 13-18, CEGC will collect water samples from the springs before drilling, during initial drilling, after drilling to 500 feet (the equivalent elevation to the springs), and after completion of these wells. If effects are identified after analysis of the samples, drilling at these wells will be halted until the hydrologic connection to the springs is better understood. BLM and the USFS will compare the samples after they are analyzed.	CEGC will collect and analyze water samples from Paynes Springs. CEGC will submit the water sample analyses to the BLM and USFS for comparison. CEGC will halt drilling at well pads 56-18 and 13-18 if effects to the springs are identified.	Compare and analyze water sample analyses from Paynes Springs that have been collected by CEGC. The water samples will be collected before drilling, during initial drilling, after drilling to 500 feet, and after well completion.	BLM and USFS	Compare and analyze each water sample analysis from Paynes Springs immediately following the submittal of each sample analysis from CEGC to the BLM and USFS.

CULTURAL RESOURCES

MITIGATION MEASURE	IMPLEMENTATION PROCEDURE	MONITORING AND REPORTING ACTIONS	RESPONSIBLE AGENCY	MONITORING SCHEDULE
4.4.1 If archaeological resources are discovered during excavation for the proposed action, all work in the immediate vicinity will be suspended pending site investigation by the USFS and a qualified archaeologist to assess the materials and determine their significance. If the qualified professional determines that the resource will yield new information or important verification of previous findings, construction in the immediate area will not resume until the USFS and SHPO have been consulted and the resources appropriately evaluated and treated.	If a resource is discovered, CEGC will suspend all work in the vicinity of the resource and notify the USFS and an archaeologist for resource evaluation. Work will not resume until the USFS and SHPO have evaluated and treated the resource.	1) Inspect each pad during construction to verify that no resources have been discovered. 2) If a resource is discovered, inspect the site and consult with SHPO and a qualified archaeologist to evaluate the significance of the resource.	USFS	1) Inspect each pad once during construction to verify that no resources have been discovered. 2) If a resource is discovered, inspect the site and consult with SHPO and a qualified archaeologist immediately following notification from CEGC of the discovery of the resource.
4.4.2 If prehistoric archaeological deposits that include human remains are discovered by the project sponsor or any construction contractors during excavation for the proposed action, the County Coroner will be immediately notified. If the remains are found to be Native American, local Native American groups and the Native American Heritage Commission (NAHC) will be notified within 24 hours. The most likely descendants of the deceased Native American will be notified and given the chance to make recommendations for the remains. If no recommendations are made within 24 hours, remains may be reinterred elsewhere on the property. If recommendations are made and not accepted, the NAHC will mediate the problem.	If human remains are discovered, CEGC will suspend all work in the vicinity of the remains and notify the County Coroner and the USFS. If the remains are Native American, local Native American groups and the NAHC will be notified. Work will not resume until interment of the remains has been resolved.	1) Inspect each pad during construction to verify that no human remains have been discovered. 2) If human remains are discovered, notify the County Coroner; if the remains are Native American, notify local Native American groups and the NAHC.	USFS/County Coroner	1) Inspect each pad once during construction to verify that human remains have not been discovered. 2) If human remains are discovered, notify the Coroner immediately following notification from CEGC of the discovery of the remains. If the remains are found to be Native American, notify local Native American groups and the NAHC within 24 hours of this determination.
4.4.3 If archaeological resources are discovered during excavation for the proposed action and avoidance of these resources is not feasible, evaluation of the resources will be required. An evaluation plan will be prepared that provides for the methodical excavation of resources that would be adversely affected. Only a qualified archaeologist or cultural resources consultant will be allowed to collect any discovered prehistoric resources. The work will be accomplished within the context of a detailed research design and in accordance with current professional standards. The plan will result in the extraction of sufficient volumes of non-redundant archaeological data so as to address important regional research consideration, and detailed technical reports will be prepared to document the findings.	If necessary, CEGC will contract with a qualified archaeologist or cultural resources consultant to prepare an evaluation plan and a plan to conduct resource treatment, collect discovered prehistoric resources, and prepare technical reports to document the findings.	If necessary, review the evaluation plan for excavation of discovered prehistoric resources to ensure adequacy. Attend the implementation of the collection plan, and review all technical reports that are prepared to document the findings.	USFS	If required, review the evaluation plan for resource excavation prior to collection of any resources. Attend the collection of resources during resource collection, and review the technical reports immediately following their preparation.

Mitigation Monitoring and Reporting Program (Continued)

BIOLOGY

MITIGATION MEASURE	IMPLEMENTATION PROCEDURE	MONITORING AND REPORTING ACTIONS	RESPONSIBLE AGENCY	MONITORING SCHEDULE
4.5.1 Conifers over 14 inches dbh will be avoided where feasible during pad construction. In addition, implementation of Mitigation Measure 4.2.2 will ensure that there would be no erosion effects to vegetation.	CEGC will avoid conifers over 14 inches dbh where feasible during construction and will document where it is not feasible to avoid certain conifers over 14 inches dbh.	Inspect each pad prior to construction to identify conifers that could be avoided and conifers that would be removed, and inspect after construction to verify that identified conifers have been avoided.	USFS	Inspect each pad prior to construction and immediately following construction.
4.5.2 For the northern spotted owl, seasonal restrictions will be imposed by the USFS for all proposed well pad and access road locations. Under these restrictions, no construction or drilling may take place at the well pads between February 1 and August 15. For all well pads except for pad sites 63-20TCH and 15-15TCH, seasonal restrictions will be imposed until completion of protocol requirements (i.e., the second-year surveys). The second-year surveys will consist of site visits during the appropriate survey period. Upon completion of the surveys, one of two actions will be taken depending on the results of the surveys. If there are no owl responses, it will be determined that the proposed action would not have an effect on the owl, and the USFS will release the well pads from seasonal restrictions for owls. If there are owl responses, the USFS will require the seasonal restrictions as mitigation, and these restrictions will remain in place for those well pads that are in the vicinity of the responses. The seasonal restrictions for pad sites 63-20TCH and 15-15TCH will remain in place for the life of the proposed action or until northern spotted owl protocol requirements are completed for these pads.	CEGC will adhere to all seasonal restrictions until completion of northern spotted owl protocol requirements. If there are owl responses during second-year surveys at the well pads, CEGC will continue to adhere to seasonal restrictions for all well pads where there were owl responses.	Add the seasonal restrictions for northern spotted owl to the conditions of approval for the proposed action. For all well pads except 63-20TCH and 15-15TCH, coordinate with CEGC to ensure that no construction or drilling takes place at the well pads between February 1 and August 15 until completion of northern spotted owl protocol requirements. Upon protocol completion, lift seasonal restrictions for applicable pads. For sites 63-20TCH and 15-15TCH, coordinate with CEGC to ensure that no construction or drilling takes place at the well pads between February 1 and August 15 unless northern spotted owl surveys are undertaken and the protocol requirements are met for these pad sites.	USFS	Coordinate with CEGC prior to February 1 each year to ensure compliance with seasonal restrictions; verify through random site inspections until August 15 that seasonal restrictions are not being violated.
4.5.3 For the northern goshawk, seasonal restrictions will be imposed by the USFS for all proposed well pad and access road locations. Under these restrictions, no construction or drilling may take place at the well pads between February 1 and August 15. For all well pads except for pad sites 63-20TCH and 15-15TCH, seasonal restrictions will be imposed until completion of protocol requirements The goshawk surveys will consist of nesting surveys in May 1995. Upon completion of these surveys, one of two actions will be taken depending on the results of the surveys. If no goshawks or active goshawk nests are identified, it will be determined that the proposed action would not have	CEGC will adhere to all seasonal restrictions until completion of northern goshawk protocol requirements. Upon completion of goshawk surveys, CEGC will continue to adhere to seasonal restrictions for all well pads where goshawk presence was recorded.	Add the seasonal restrictions for northern goshawk to the conditions of approval for the proposed action. For all well pads except 63-20TCH and 15-15TCH, coordinate with CEGC to ensure that no construction or drilling takes place at the well pads between February 1 and August 15 until completion of goshawk protocol requirements. Upon protocol completion, lift seasonal restrictions for applicable pads.	USFS	Coordinate with CEGC prior to February 1 each year to ensure compliance with seasonal restrictions; verify through random site inspections until August 15 that seasonal restrictions are not being violated.

BIOLOGY (Continued)

MITIGATION MEASURE	IMPLEMENTATION PROCEDURE	MONITORING AND REPORTING ACTIONS	RESPONSIBLE AGENCY	MONITORING SCHEDULE
an effect on the goshawk, the USFS will release the well pads from seasonal restrictions for goshawk, and the protocol would be deemed complete. If there are goshawk or active goshawk nests, the USFS will require that the seasonal restrictions be left in place until completion of the post-fledgling dependency period survey in early July through late August. The results of the second surveys (if needed) will again result in one of two actions being taken. If there is no response during the second survey, it will be determined that the proposed action would not have an effect on the goshawk, and the seasonal restrictions for goshawk will be lifted. If goshawk presence is confirmed during the second survey, the USFS will require as mitigation that the seasonal restrictions remain in place for those well pads that are in the vicinity of the responses to avoid effects to goshawk. The seasonal restrictions for pad sites 63-20TCH and 15-15TCH will remain in place for the life of the proposed action or until northern goshawk protocol requirements are completed for these pads.		For sites 63-20TCH and 15-15TCH, coordinate with CEGC to ensure that no construction or drilling takes place at the well pads between February 1 and August 15 unless northern goshawk surveys are undertaken and the protocol requirements are met for these pad sites.		
4.5.4 For the American marten, CEGC will provide compensation mitigation for removal of marten habitat. Compensation mitigation will consist of placing d/d material from the well pads in concentrated debris piles near but somewhat isolated from the well pads, which will create denning sites for the marten. One to two piles per acre of disturbed marten habitat will be provided. Approximate minimum dimensions of the piles will be eight feet wide by four feet tall by 10 feet deep. The extent of compensation and the locations of mitigation sites would be determined by field surveys conducted by the USFS and CEGC prior to any construction activities at well pads.	CEGC will coordinate with the USFS to provide appropriate compensation mitigation for removal of marten habitat. CEGC will then implement appropriate compensation mitigation for removal of marten habitat.	Coordinate with CEGC to conduct field surveys prior to any construction activities at well pads to identify the extent of marten compensation and the locations of mitigation. Verify implementation of appropriate compensation mitigation.	USFS	Conduct field surveys to identify the extent of marten compensation and the locations of mitigation prior to any construction activities at well pads. Verify implementation of appropriate compensation mitigation following construction activities at each well pad.
4.5.5 Construction materials and equipment will arrive and leave all well pad sites by way of existing roads or through existing disturbed areas. Construction materials and equipment will not be allowed to cross areas that are to remain undisturbed. Construction materials and equipment will be stored within disturbed areas either at or near the well pad sites.	CEGC will avoid areas that are to remain undisturbed when accessing well pad sites and will store materials and equipment within disturbed areas.	Inspect well pad sites to ensure that activities are not occurring in areas that are to remain undisturbed.	USFS	Randomly inspect well pad sites during project activities to ensure that activities are not occurring in areas that are to remain undisturbed.

Mitigation Monitoring and Reporting Program (Continued)

BIOLOGY (Continued)

MITIGATION MEASURE	IMPLEMENTATION PROCEDURE	MONITORING AND REPORTING ACTIONS	RESPONSIBLE AGENCY	MONITORING SCHEDULE
4.5.6 Where feasible, CEGC will top existing snags in adjacent areas to make these snags more suitable for use by wildlife species.	CEGC will coordinate with the USFS to identify snags that could be topped, and will top snags where feasible.	Identify snags that could be topped, and verify that these snags have been topped	USFS	Identify snags for topping during field surveys prior to construction, and verify following construction.

LAND USE, RECREATION, AND TRANSPORTATION SYSTEMS

MITIGATION MEASURE	IMPLEMENTATION PROCEDURE	MONITORING AND REPORTING ACTIONS	RESPONSIBLE AGENCY	MONITORING SCHEDULE
4.9.1 All heavy vehicles associated with the proposed project (particularly water and other trucks accessing well pads 15-15TCH and 63-20TCH) will avoid using Road 43N48 in order to avoid potential damage to this road and to minimize the potential for conflicts between vehicles associated with the proposed action and recreational uses and motorists associated with the Medicine Lake campgrounds. Water for activities at these well sites will either be obtained from existing sources west of the well sites or trucked from the Arnica Sink wells on roads to the north of Road 43N48.	CEGC will avoid use of Road 43N48 by water trucks and other heavy trucks such as drill rig trucks.	Coordinate with CEGC to ensure that heavy vehicles associated with the proposed action do not use Road 43N48, and that an acceptable alternative route is identified. Verify compliance during lifespan of the proposed action.	USFS	Coordinate with CEGC to regarding heavy vehicle use of Road 43N48 prior to implementation of the proposed action. Verify compliance during lifespan of the proposed action.
4.9.2 CEGC will submit design plans to Modoc County and the USFS for the intersection of the access road for pad 56-18 and PFR 97 to ensure that traffic at the intersection will not create a public safety hazard.	CEGC will submit design plans to Modoc County and the USFS for the intersection of the access road for pad 56-18 and PFR 97, and Modoc County and the USFS will review these design plans to ensure that the intersection will not create a public safety hazard.	Review the design plans for the intersection of the access road for pad 56-18 and PFR 97 to ensure that the intersection will not create a public safety hazard.	USFS/Modoc County	Review and make any revisions to the design plans for the intersection of the access road for pad 56-18 and PFR 97 prior to construction of well pad 56-18 and development of the access road to the pad.

APPENDIX D: Public Comments and Responses

APPENDIX D: Public Comments and Responses

Appendix D includes the comment letters that were received during the public review period for the Glass Mountain Unit Geothermal Exploration Project Environmental Assessment/Initial Study (EA/IS). The public review period began on April 24, 1995, and closed on May 24, 1995. A total of 13 comment letters were received during the review period.

This appendix also includes responses to environmental issues raised in the comment letters. Each comment letter has been assigned an alpha designation (e.g., the first comment letter presented in this appendix is designated as "Letter A"), and a comment number has been assigned to each individual comment (e.g., the first comment in Letter A is designated as "A.1"). The responses are keyed to the numbered comments.

24 May 1995

Mr. Randall Sharp
FS/BLM Project Coordinator
800 W. 12th Street
Alturas, California 96101

Subject: Comments on Glass Mountain Unit Geothermal Exploration Project Environmental Assessment/Initial Study

Dear Mr. Sharp:

This letter presents comments on the subject report, prepared for the Plan of Operation (POO) for exploratory geothermal drilling within the Glass Mountain Known Geothermal Resource Area (KGRA) in the Medicine Lake Highlands. My family has owned a cabin near Medicine Lake for about 30 years. In addition, I am a registered geologist and licensed professional engineer in the state of California and completed my masters thesis in the evaluation of the viability of geothermal fields in energy production.

The subject report was well written and well organized. My primary comment is on the lack of technical detail or supporting data for many of the statements in the report. Examples of this lack of technical detail or supporting data are provided below. A.1

- Page 2-14 states that TCH well operations would require approximately 3,000 to 5,000 gallons of water per day and well pad operations would require approximately 9,000 gallons of water per day. The report does not state how these estimates were derived or on what data they are based. A.2

- Page 4-4 states that "minor balanced cut and fill would be required for roads, but would not significantly alter the topography of the area." The report does not indicate what is considered "minor" or significant. A.3

- Page 4-5 states that "CEGC also proposes to use adequate casing and cementing" to avoid blow-outs and that, in case of a blow-out, the effects on the environment would not be expected to be "significant". The report does not indicate what "adequate casing and cementing" consists of for this project nor what is considered to be a signicant effect to the environment. A.4

- Page 4-7 provides "Significance Criteria" for evaluating potential impacts to the hydrogeologic setting of the area. Four of the six criteria consider "substantial" effects to be of significance; however, no measurement of what is considered "substantial" is provided. A.5

- Page 4-8 indicates that the geothermal drilling would not "significantly" deplete water resources in the vicinity. Once again, the definition of significantly is not provided. A.6

- Page 4-8 states that proposed activities would not affect the water levels in Medicine Lake because the wells would be cased and cemented and only geothermal fluids from the deeper geothermal reservoir below 3,000 feet deep would be withdrawn from the exploration wells. However, the report does not provide a clear understanding of the geological and hydrogeological setting of the area and no geologic cross-sections are provided to illustrate and support the above statement. In addition, the report does not indicate whether recharge to the pumped zone will occur laterally or vertically, nor what is the interconnectivity of the water bearing zones in this area. In short, no backup for this statement is provided in the report. A.7

According to comment letters contained in Appendix B of the report, many people have expressed concern about the affect of the proposed work on the water level in Medicine Lake. As outlined in several of the examples above, the report does not provide enough information to assess whether the activities will or will not have an affect on Medicine Lake. It is also not clear from the report whether an assessment of this nature has been completed. A brief description of the hydrology of the area is provided on page 3-4; however, no references were provided to indicate where (or how) this information was obtained. A.8

In addition, I believe many of the long-time visitors and summer residents of this area (myself included) are worried that these activities will alter the physical landscape of the area; therefore, statements that indicate the area will not be "significantly altered" do not provide enough information to assess for oneself if the alteration is or is not significant. What CEGC considers to be "significant" may differ from what visitors consider "significant". A.9

The report also did not provide enough technical information for the reader to assess the scope of the proposed work and evaluate the need for all of the proposed temperature core holes and exploration well pads. The report indicated that CEGC believed that all of the test sites were necessary to achieve the data necessary to determine whether the geothermal resource in the area is viable for commercial development. A summary of previously obtained temperature and geologic data would be helpful for the reader to assess the need for all of the test sites. A.10

As a final comment, the report did not provide a "cost-benefit" analysis of utilizing the geothermal resources in this area. Understandably, this type of analysis is likely beyond the A.11

scope of the environmental assessment/initial study. I would anticipate that this type of analysis will be conducted and results of the analysis included in future reports. A.11

I appreciate the opportunity to provide these comments. Should you have any questions, please call me at (415) 434-9400.

Sincerely yours,

Amanda L. Spencer, R.G., P.E.

Letter A—Amanda L. Spencer

RESPONSE TO COMMENT A.1

The EA/IS provides the level of technical detail and supporting data necessary to analyze the potential environmental effects of the proposed POO. Detailed information on certain aspects of the proposed project (such as well drilling and testing methods, well casing and cementing, and site safety procedures) are contained in the CEGC Plan of Operation (POO) for the project (CEGC 1994). The description of the proposed project contained in the EA/IS is a summary of the CEGC POO. The POO is on file with the BLM, USFS, and Siskiyou County APCD. In addition, technical information about the Glass Mountain geothermal resource that has been collected by CEGC has been submitted to the BLM for their files. This information is considered by CEGC to be proprietary, but has been evaluated by the BLM in the decision for the proposed POO.

RESPONSE TO COMMENT A.2

Estimates for water requirements for the proposed POO are based on historic water use rates observed by CEGC at existing TCH and exploration well sites in the Cascade Mountain range and at the Coso geothermal field in southeastern California.

RESPONSE TO COMMENT A.3

The proposed project would require the construction of approximately 2,600 feet of new access roads and improvement to about 8,150 feet of existing access roads. These activities would result in approximately 1.35 acres of surface disturbance. Most of the "cut and fill" for roads that is referenced in the second paragraph on page 4-4 of the EA/IS would actually be grading activities that would be required to provide level road surfaces. These activities would result in no more than an inch or two of dirt being cut from an area and redistributed on the road surface. It is anticipated that only the new 2,200-foot access road to well pad 46-32 and the existing 5,000-foot access road to well pad 18-32 would require cut and fill of more than a couple of inches of dirt. Since these roads are located on a sloped area, dirt would need to be removed from the upslope side of the road route and placed on the downslope side of the road route. This balanced cut and fill would allow CEGC to construct roadways to well pads 46-32 and 18-32 that are of sufficient width for access vehicles. At this time, it is not possible to quantify the exact amount of cut and fill that would be required for roads associated with the proposed project, but cuts are expected to be less than 10 feet high.

For the purposes of analyzing the potential environmental effects of the proposed project, a quantified threshold for determining a significant effect to topography was not established. Rather, changes to topography from the project were evaluated in a qualitative sense. Factors that were evaluated included:

- Whether the topography changes would be a drastic change from existing conditions
- If the changes would result in the alteration of the topography of a large area
- If the changes would be highly visible

- If the changes would alter the basic topographic character of the area (e.g., change the area from rolling hillsides to flat terrain)

If any of these conditions had been met, cut and fill activities would be considered major activities, and the project would have been considered to have a significant effect on the topography of the area. However, road construction and improvements would not drastically change the topography of the area, would affect a small area, would not be highly visible, and would not alter the basic topographic character of the area. The amount of cut and fill for road construction and improvements was therefore considered to be minor, and cut and fill would not significantly alter the topography of the area.

RESPONSE TO COMMENT A.4

CEGC would use industry-standard well casing and cementing, as defined by Geothermal Resources Operational (GRO) Order No. 2. Casing would meet steel requirements for wall thickness and tensile strength. Cementing would be performed with cements that are specifically designed for geothermal wells. The well casing and cementing is designed to withstand the pressures and temperatures of the Glass Mountain geothermal resource. The specifics of the casing and cementing are based on CEGC's extensive geothermal drilling experience and knowledge of the Glass Mountain geothermal resource. Detailed information on well casing and cementing are contained in the CEGC Plan of Operation (POO) for the project (CEGC 1994).

A well blow-out would be considered to have a significant effect on the environment if it would result in a significant effect as defined by the significance criteria that are presented by parameter throughout Chapter 4 of the EA/IS. As discussed in the last paragraph on page 4-5 and in the first and second paragraphs on page 4-6, well blow-outs would have a significant effect if there was an effect on groundwater or surface water, and by affecting human health. However, the on-site sumps would prevent effects to groundwater and surface water, and the Emergency Contingency Plan that is part of the POO defines the procedures that would avoid effects to human health.

RESPONSE TO COMMENT A.5

The significance criteria identified for hydrology on pages 4-7 through 4-8 of the EA/IS are drawn from Appendix G of the CEQA Guidelines. For the four significance criteria that use the term "substantial," neither CEQA nor the CEQA Guidelines provide quantified measurement of what is considered to be a substantial effect. For the purposes of analyzing hydrology effects of the proposed project, the following factors were used to qualitatively evaluate potential substantial effects of the project. The impacts of the proposed project would not exceed any of these criteria.

Depletion of Groundwater Resources

A substantial depletion of groundwater resources would be a depletion that results in a long-term change to groundwater levels or results in other indirect environmental effects (such as drying up of groundwater-fed wetlands or habitat that is critical to certain wildlife species). If the resource is being used by humans as a water source or for

agriculture, a project that would deplete the resource such that the current demand for water could not be met would also be considered a substantial depletion of groundwater resources.

Degradation of Water Quality

Substantial degradation of water quality would be degradation of groundwater or surface water that injures or kills vegetation that is exposed to the water, injures or kills wildlife that is exposed to the water, harms human health, or prevents human use.

Groundwater Recharge

Substantial interference with groundwater recharge would occur if project implementation results in a drop in groundwater levels that are beyond the normal fluctuation of the groundwater resource. This could occur by preventing surface waters and/or rain from percolating into the ground and adding water to the groundwater resource.

Flooding

Substantial effects due to flooding would occur if project implementation would result in the exposure of people or property to flood waters or an increase in the risk of flooding.

RESPONSE TO COMMENT A.6

See the response to comment A.5. A significant depletion of water resources would be a depletion that results in a long-term change to groundwater or surface water levels, results in indirect environmental effects, or affects the ability of the water resource to meet the current demand for water.

RESPONSE TO COMMENT A.7

Sections 3.2, Geology and Soils and 3.3, Hydrology in the EA/IS provide overviews of the geology and hydrogeology of the area, respectively. Certain information related to the geology and hydrogeology of the area (such as geologic cross-sections) is considered by CEGC to be proprietary. This information is on file with the BLM, and has been evaluated by the BLM in the decision for the proposed POO. The following discussion of geology and hydrogeology expands on the information contained in the EA/IS.

The water levels in the many surface lakes and water wells within the six-mile basin that encloses Medicine Lake indicate that an extensive groundwater body exists within the basin. The lakes within the basin are thought to represent the surface of this groundwater body. The surfaces of the lakes are located at an elevation of about 6,670 feet above sea level. Natural fluctuations in water levels of approximately 10 feet indicate that variable permeability exists in the subsurface of the groundwater body.

A deeper regional water body also exists in the Medicine Lake area. It is this deeper water body that contains the geothermal system that would be subject to geothermal testing and exploration activities by CEGC. Water levels of the deeper water body have been

evaluated during previous geothermal well and core hole drilling in the area. These evaluations have determined that the deeper water body has standing water levels of about 5,900 feet above sea level (which is about 800 feet lower than the surface of the upper groundwater body).

Based on the different water level elevations of the two groundwater bodies, the groundwater body that makes up Medicine Lake and the other surface lakes appears to be a perched, fairly well-contained groundwater body that overlies and is separated from the deeper regional water body. The stratum that is responsible for this separation may be glacial till or a type of ash deposit. Further support for the separation of the two groundwater bodies is the lack of hot springs, despite the presence of a very large geothermal resource at depth. Given this separation, the proposed geothermal well drilling and testing of the deeper water body would not affect water levels at Medicine Lake. Only limited geothermal fluids would be withdrawn from the deeper reservoir during geothermal well drilling and testing. Even if the separation of the two groundwater bodies is not complete, there would not be a significant impact from geothermal fluid withdraw due to the small amount of fluids that would be withdrawn. The casing that would be used for geothermal wells would also protect the shallow groundwater body.

The only activity associated with the proposed POO that could affect the perched groundwater body would be pumping of groundwater from the two existing water wells in the Arnica Sink area. The pumped water would supply water for drilling needs and dust control. As discussed on page 4-8 of the EA/IS, this pumping would be of short duration, would utilize an extremely small amount of the groundwater that is available in the perched groundwater body, and would be spread out over time. Any groundwater drawdown that might occur would result in a localized cone of depression that would be confined to the Arnica Sink basin, and would not affect Medicine Lake. Recharge to the pumped zone would occur laterally for most of the year. During periods of snow melt-off, recharge would occur vertically.

To summarize, the water levels at Medicine Lake are not expected to be affected by the proposed drilling because:

- The geothermal wells would produce limited quantities of geothermal fluids during drilling and testing
- The geothermal fluids would be produced from the lower groundwater body, which is 800 feet deeper than the groundwater system that supports Medicine Lake
- Geothermal wells would be cased, which would protect the groundwater system that supports Medicine Lake

RESPONSE TO COMMENT A.8

See the response to comment A.7 for a discussion of why the proposed POO would not affect lake levels at Medicine Lake, and the response to comment A.1 for a discussion of the level of detail that has been provided in the EA/IS. As discussed on page 3-1 of the

EA/IS, the following documents were used as general references for preparation of Chapter 3 (including Section 3.3, Hydrology):

- *Geothermal Leasing of National Forest Lands in the Glass Mountain Known Geothermal Resource Area Supplemented Environmental Assessment* (BLM and USFS 1984)
- *Modoc National Forest Land and Resource Management Plan* (USFS 1991a)
- *Modoc National Forest Land and Resource Management Plan Final Environmental Impact Statement* (USFS 1991b)

Additional references specific to Section 3.3, Hydrology are identified in Chapter 6, References, of the EA/IS.

RESPONSE TO COMMENT A.9

As discussed in the response to comment A.3, development of roads for the proposed POO would not significantly alter the topography or physical landscape of the area. This is also true for the proposed well pad sites. As discussed on pages 4-3 to 4-4 of the EA/IS, the development of roads and well pad sites would require minimal cut and fill and grading, and well pads would generally be located on level and previously disturbed areas. Roads and well pad sites associated with the proposed POO would occupy about 29.6 acres, which represents an extremely small portion of the Modoc National Forest. As discussed in Section 4.8, Visual Resources, of the EA/IS, implementation of the proposed POO would not significantly affect long-range or short-range views in the area. Since the development of roads and well pad sites would not drastically change the topography of the area, would affect a small area (and an extremely small portion of the Forest), would not be highly visible, and would not alter the basic topographic character of the area, the proposed POO would not significantly alter the physical landscape of the area.

RESPONSE TO COMMENT A.10

See the response to comment A.1 for a discussion of the level of technical detail about the proposed project that has been provided in the EA/IS. The description of the proposed CEGC Plan of Operation (POO) contained in the EA/IS is a summary of the POO (CEGC 1994), which is on file with the BLM, USFS, and Siskiyou County APCD. Previously obtained temperature and geologic data are considered by CEGC to be proprietary. These data are on file with the BLM, and have been evaluated by the BLM in the decision for the proposed POO.

RESPONSE TO COMMENT A.11

The commentor is correct in noting that a cost-benefit analysis of development and utilization of the geothermal resource within the Glass Mountain KGRA is beyond the scope of the EA/IS for the proposed exploration project. As discussed on page 1-11 of the EA/IS, it is uncertain at this time whether a commercially viable geothermal resource actually exists. Only exploratory geothermal drilling and testing is proposed in the POO; no development or utilization of the geothermal resource within the KGRA is proposed. Since it is not known at this time if development or utilization of the geothermal resource would occur as a result of the proposed POO, this EA/IS addresses only the activities described in the POO.

If a commercially viable geothermal resource is discovered within the Glass Mountain KGRA, development and utilization of the geothermal resource would require the preparation of separate Plans of Development and Utilization. These future plans (if warranted) would describe detailed plans for construction and operation of geothermal facilities such as a power plant, transmission line, and development well field. Similar to the POO, these plans would be subject to environmental review and public comment.

STATE OF CALIFORNIA—THE RESOURCES AGENCY

PETE WILSON, Governor

DEPARTMENT OF FISH AND GAME
601 LOCUST STREET
REDDING, CA 96001
(916) 225-2300

May 24, 1995

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 3

To Randy Sharp	From Pat Griffin
Co. USFS	Co.
Dept.	Phone #
Fax # 916-233-5817	Fax # 916-233-5677

Mr. Patrick J. Griffin
Siskiyou County Air Pollution Control District
525 South Foothill Drive
Yreka, California 96097

Dear Mr. Griffin:

Glass Mountain Unit Geothermal Exploration Project
Environmental Assessment/Initial Study
SCH 95041056

The California Department of Fish and Game has reviewed the Glass Mountain Unit Geothermal Exploration Project environmental assessment/initial study, the draft decision record and draft finding of no significant impact for the project. The California Energy General Corporation (CEGC) proposes to implement a plan of operation (Plan) for exploratory geothermal drilling with the Glass Mountain Know Geothermal Resource Area (KGRA) located in the Medicine Lake Highlands on the Modoc and Shasta-Trinity national forests in Siskiyou County. In the proposed Plan, CEGC proposes to drill five exploratory geothermal temperature core hole (TCH) wells; drill, complete and test deep (production size) exploration wells at five well pads within the Glass Mountain KGRA.

The project proposes to construct approximately 2,600 feet of new access roads and improvement to 8,150 feet of existing access roads. Total surface disturbance is estimated to be 29.6 acres. To minimize the increase in road density in the Glass Mountain area and reduce harassment to wildlife, newly constructed or improved roads should be permanently gated to prevent vehicle entry. These gates should be closed and locked when construction or drilling activities are not taking place. These roads should also remain closed during hunting seasons. Permanently locked gates will also facilitate successful revegetation efforts of abandoned access roads. B.1

The environmental assessment's (EA) reclamation section states that if wells are found to be nonproductive, wells will be abandoned and well pads and access roads will be restored to their preproject condition. Objectives and success criteria should be developed to gauge successful revegetation of the sites. Revegetation can be considered successful when the sites have revegetated at a level of eighty percent of the adjacent ground cover within five years. If natural revegetation of the well pad sites and access roads are not meeting the performance standards, the project proponents should actively revegetate these areas with local native seed stock. This can include planting lodgepole pine, red fir and other tree species that are listed in Table 3.5-1 of the EA. A revegetation plan should be submitted with details on site preparation, performance standards, monitoring methods and reporting schedule. If site data B.2

containing information on revegetation rates exists on comparable drilling well sites occurring in the Glass Mountain KGRA, that data should be made available to analyze the potential for successful revegetation efforts for this proposed project. B.2

TCH drilling operations will require approximately 3,000 to 5,000 gallons of water per day for 25-60 days. Exploratory wells require up to 9,000 gallons per day for 60-90 days of operation. Up to 40,000 gallons could be required in lost circulation zones. Water for drilling operations will be extracted from two wells at Arnica Sink and possibly Harris Springs and Pumice Stone wells. Water can be a limited resource in this area and wildlife in the area depend upon dispersed available water sources. The EA claims that geothermal drilling would not significantly deplete water resources in the vicinity. The US Geological Survey is proposing to assume hydrologic monitoring responsibilities for the Glass Mountain area and has prepared a draft hydrologic monitoring plan that identifies a proposed monitoring program. Since this hydrologic monitoring plan is only in the draft stage, this EA should provide a specific monitoring plan that will be implemented to ensure that water resources in the Glass Mountain KGRA are not significantly affected by the proposed activities. B.3

To prevent possible injury to deer and other animals, plastic fencing has been proposed to prevent access by wildlife into the well pad areas. This may be ineffective at keeping other wildlife from entering the sumps. Birds and small mammals could potentially be attracted to the sumps and become trapped. The project proponent should provide some alternatives that could be implemented if this problem occurs. B.4

Thank you for your consideration of these comments. If you have any questions regarding our review of this project, please contact our staff biologist Ms. Terri Weist at (916) 938-1169.

Sincerely,

Randol C. Beuthin Jr.

Richard L. Elliott
Regional Manager

cc: See attached list

cc: Ms. Terri Weist
Department of Fish and Game
1724 Ball Mountain Road
Montague, California 96064

Mr. Rich Burns
Bureau of Land Management
Susanville District, Alturas Resource Area
708 West 12th Street
Alturas, California 96101

Mr. Bernie Weisgerber
US Forest Service
Modoc National Forest
800 West 12th Street
Alturas, California 96101

Letter B—California Department of Fish and Game

RESPONSE TO COMMENT B.1

As discussed on page 2-3 of the EA/IS, CEGC would install gates on certain access roads and pad entrances to control vehicle access to well pads. Roads that would be gated would generally be those roads that require road improvements or construction. As shown in Table 2.1-1 on page 2-4 of the EA/IS, 7 of the 10 proposed well pad sites would require road improvements or construction. All gates installed by CEGC would have dual locks to allow access to BLM and USFS personnel. These gates would be locked at all times, except the periods when construction and drilling are taking place.

RESPONSE TO COMMENT B.2

The USFS would be responsible for monitoring revegetation at all TCH well pad sites and at those exploration well pad sites that would require reclamation. As discussed on page 2-17 of the EA/IS, CEGC would be responsible for posting reclamation bonds to ensure that all project activities would be reclaimed in a timely manner following completion of the proposed action. A revegetation plan that specifies objectives, performance standards, monitoring methods, and a reporting schedule would be submitted by CEGC to the BLM and USFS at the time that the reclamation bonds are posted.

Both the USFS and CEGC are interested in appropriate reclamation of well pad sites following completion of the proposed action. As discussed on page 2-2 of the EA/IS, all of the well pads except 46-32 would be at least partially located on old log landings, logging roads, or in previously clear-cut areas. These areas have been subject to surface disturbance in the past, and currently show evidence of this previous surface disturbance. For these well pads, reclamation would involve restoring the sites to conditions that existed prior to the original surface disturbance (as opposed to pre-project conditions), to the greatest extent feasible. For well pad 46-32, reclamation would involve restoring the site to pre-project conditions since there has been no previous surface disturbance at this site.

In order to develop the revegetation plan for the proposed action, surveys of each well pad site will be conducted prior to any construction at the well pads. These surveys will identify the richness, diversity, and species composition of existing vegetation at each well pad. For the well pads that have been subject to previous surface disturbance, the vegetation surveys will include an identification of the richness, diversity, and species composition of existing vegetation in immediately adjacent areas to match as closely as possible the original vegetation conditions.

Observation of existing well pads in the Glass Mountain KGRA demonstrates that revegetation of well pads occurs naturally and relatively rapidly (although no data on actual revegetation rates have been collected). Since CEGC would take pro-active steps to facilitate reclamation and revegetation of well sites and access roads (see page 2-17 of the EA/IS), it is expected that revegetation would be successful. The revegetation plan that

will be developed for the proposed action will ensure that the revegetation that occurs is compatible with existing vegetation in the area.

RESPONSE TO COMMENT B.3

As discussed in the EA/IS, the proposed project would not be expected to significantly deplete water resources in the project vicinity. Additional information to further substantiate the conclusion that there would not be a significant depletion of water resources due to project implementation is provided in the response to comment A.7. Data collected by CEGC on the geologic and hydrologic systems in the area support the conclusion that the POO would not significantly affect water resources in the area. In addition, as discussed in Mitigation Measure 4.3.1 on pages 4-12 to 4-13 of the EA/IS, a water sampling program will be conducted by CEGC (under direction of BLM and USFS) at Paynes Springs in order to verify that no effects are occurring at this spring. Since the project would not significantly affect water resources in the area, there is no need to provide hydrologic monitoring for the proposed project.

RESPONSE TO COMMENT B.4

The plastic fencing that would be placed around the perimeter of the well pad sites would be similar to the fencing that is currently in use at existing well pad sites within the Glass Mountain KGRA. This fencing has been in use for several years at the well pad sites, and no instances of wildlife mortality resulting from the fencing has been known to occur. The fencing is of fine gauge and has prevented small mammals from entering existing well pad sites in the area; small mammals are therefore not expected to enter any of the well pad sites and become trapped.

It is possible that birds could be attracted to the sumps at the five exploration well pad sites. However, any birds that are attracted to the sumps would be expected to be able to fly away from the well pad sites. It is therefore not expected that any birds would be trapped at any of the well pad sites.

Letter C

BUTTE VALLEY CHAMBER OF COMMERCE

BOX 541, DORRIS, CALIFORNIA 96023

May 5, 1995

Randall Sharp
Modoc National Forest
800 West 12th St.
Alturas, Ca. 96101

Ref: EA #CA027-EA95-06, Glass Mountain Unit Geothermal Exploration Project

Dear Mr. Sharp,

The Butte Valley Chamber of Commerce is in opposition to Alternate A of the referenced Environmental Assessment for the following reasons.

1. The chamber is adamantly opposed to the siting of a power plant anywhere near Medicine Lake! The only practical reason for drilling so close (42-13TCH and 15-15TCH) to the lake would be to identify such sites. C.1

2. You have grossly underestimated the impact on Medicine Lake which would result from the drilling operations. Nearby property owners well remember the last drilling(s). The noise levels provided are only estimates and at that are only slightly below the safety levels for workers allowed by OSHA. C.2

3. The total area of disturbance, 29.6 acres, is also excessive. Drilling professionals in the area indicate that only of fraction of the proposed clearing for pads is necessary. C.3

The chamber is in support of Alternate B. Your own assessment of Alternate B, reference page 4-7, indicates that "the potential for geologic hazards to affect people or facilities would be eliminated." C.4

In summary the risks of any magnitude to Medicine Lake are just not worth taking!

Sincerely,

J. K. Covington, President

cc: Rep. Herger
Sen. Boxer
Sen. Feinstein

CALENDAR PAGE	735
MINUTE PAGE	002218

Letter C—Butte Valley Chamber of Commerce

RESPONSE TO COMMENT C.1

The opposition of the Butte Valley Chamber of Commerce to siting a power plant near Medicine Lake is noted. As discussed in the response to Comment A.11, no development or utilization of the geothermal resource (and therefore no plans for siting of a power plant) within the Glass Mountain KGRA is currently proposed. The currently proposed project only involves exploratory geothermal drilling and testing. The siting of a geothermal power plant (if the geothermal resource development is proposed) would be undertaken as part of the process of preparing Plans of Development and Utilization. The TCH wells that would be drilled would be used to help define the extent of the geothermal resource in the area; TCH well pad sites are not usually used to site a geothermal power plant.

CEGC has identified well pad sites 42-13TCH and 15-15TCH as drilling locations that are necessary to acquire adequate information about the geothermal resource within the Glass Mountain KGRA and to determine the future commercialization potential of the geothermal resource. As discussed on page 2-8 of the EA/IS, these TCH wells would be abandoned in accordance with GRO No. 3 after completion of all testing.

The use of the 42-13TCH and 15-15TCH well pads would be a temporary, short-term use of the pads. After completion of the activities proposed in the POO, the well pads would most likely be reclaimed; however, if development or utilization of the geothermal resource is proposed, approved, and undertaken, production and/or injection wells could be drilled at the pads. Any use of the well pads other than that proposed in the POO is beyond the scope of the EA/IS, and would require additional environmental evaluation prior to authorization for additional uses.

RESPONSE TO COMMENT C.2

The analysis of potential noise impacts contained in the EA/IS is an accurate assessment of the potential noise effects associated with the proposed POO. The quantified noise levels identified in Table 4.7-1 on page 4-33 of the EA/IS are estimated noise levels that may occur. These noise levels are based on noise measurements and studies conducted at other geothermal exploration projects in rural portions of California and Oregon, and are considered to be representative of the proposed project. As discussed on pages 4-32 to 4-35 of the EA/IS, the proposed project would not expose the properties located near Medicine Lake to severe noise levels, and would not have a significant noise effect. In addition, all well drilling and testing would comply with OSHA standards for noise levels.

RESPONSE TO COMMENT C.3

The amount of surface disturbance that would occur under the proposed POO is considered by CEGC to be the minimum necessary to complete the proposed geothermal exploration program at the Glass Mountain KGRA. The TCH well pads would each be about 0.14 acres (60 feet by 100 feet), which would be the smallest-sized well pads that would allow necessary equipment, facilities, and vehicle parking to be sited at the TCH

well pads. The exploratory well pads would each be about 5.51 acres (400 feet by 600 feet). The size of exploratory well pads has been determined by:

- The depth of the well that is required (which determines the size of the drill rig and sump pond that is necessary)
- The type of geothermal resource that is present (which also determines the size of the sump pond that is necessary).
- The number of wells that will be drilled per pad

In the case of the Glass Mountain geothermal resource, CEGC will be required to drill deep wells to test the commercial viability of the geothermal resource. Deep wells will require larger drilling equipment and a larger sump pond to contain drilling and geothermal fluids. The geothermal resource is a steam and hot water (two-phase) resource. A sump that can contain 750,000 to 1,000,000 gallons is therefore required for flow testing. In addition, each of the exploratory well pads have been designed to accommodate multiple wells, which reduces the number of pads that would be required for exploration activities. By minimizing the number of well pads and associated roads, less overall surface disturbance will occur under the proposed POO.

As discussed on page 2-2 of the EA/IS, the proposed well sites have been selected to minimize the amount of new surface disturbance. With the exception of well pad 46-32, all wells would be at least partially located on old log landings, logging roads, or in previously clear-cut areas; these areas all have been subject to surface disturbance in the past. In order to minimize surface disturbance from development of new access roads, these roads have been routed as directly as possible from existing roads to the well pads, taking into account the topography of the area and the need to avoid sensitive elements where feasible (e.g., any larger trees that could be considered to be old growth trees).

RESPONSE TO COMMENT C.4

The support of the Butte Valley Chamber of Commerce for Alternative B is noted. Alternative B would not completely eliminate the potential for geologic hazards to affect people or facilities. As stated in the first and second sentences of the paragraph on page 4-7, Alternative B would eliminate the potential for geologic hazards to affect people or facilities only at well pads 42-13TCH and 15-15TCH (which would not be constructed under Alternative B). However, the potential for geologic hazards to affect people or facilities at other well pads would still exist. These impacts would be considered less than significant.

2655 Por. e Bay East, Suite 5 • Davis, Calif. nia 95616 • (916) 758-0380
Facsimile (916) 758-0382 • jeaton@dcn.davis.ca.us

Letter D

May 23, 1995

Randall Sharp
Modoc National Forest
800 West 12th. Street
Alturas, CA 96101

Subject: Glass Mountain Unit Geothermal Exploration Project EA/IS

Dear Mr. Sharp:

Thank you for this opportunity to comment on the Glass Mountain Unit Geothermal Exploration Project EA/IS. While we welcome alternative energy development, we also strongly believe that old-growth ecosystems and roadless areas must not be sacrificed in the process.

The Mount Hoffman Roadless Area is an important wildlife habitat corridor between the Modoc, Shasta-Trinity, and Klamath national forests. As the EA/IS reveals, the roadless area and surrounding lands provide a refuge for several sensitive wildlife species, including northern spotted owl, American marten, goshawk, bald eagle, pileated woodpecker, and peregrine falcon. As the only portion of the Modoc National Forest covered by President Clinton's Northwest Forest Plan, the area has special significance.

The EA/IS fails to take into account several Northwest Forest Plan standards and guidelines:

- Are any of the proposed drilling sites within managed late-successional reserves or riparian reserves? If so, how will the proposed drilling, logging, and road construction projects be changed to conform to the applicable standards and guidelines for these management areas? D.1

- A watershed analysis must be completed before *any* management activities are carried out in the Mount Hoffman Roadless Area (FSEIS, p. 3&4-281). When will this analysis be completed? D.2

- Is the old-growth logging proposed under Alternative A in a watershed where 15 percent or less of the federal forest land is late-successional forest? If so, no cutting of late-successional forest is allowed (S&G, p. C-44-45). D.3

- How will the "survey and manage" requirements be followed (S&G, p. C-4-5 and p. C-49-61, Table C-3)? D.4

CALENDAR PAGE	738
MINUTE PAGE	002221

We request that the final version of the EA/IS specifically address these and other standards and guidelines from the Northwest Forest Plan by explaining why they do or do not apply to the proposed project. If it is determined that these standards and guidelines apply, we request that the final version of the EA/IS explain how they are being met within the project area. D.5

In addition, Alternatives A and B violate Forest Service regulations because they propose to develop portions of the Mount Hoffman Roadless Area without requiring that an EIS be prepared (FSH 1909.15 Section 20.6 WO Amendment 1909.15-92-1). Removing old-growth forest and constructing roads and drilling pads in the Mount Hoffman Roadless Area is certainly a "substantial alteration" as defined in the FSH. If Alternative A or B is selected, we request that an EIS be prepared prior to developing the roadless area. D.6

Lastly, it is important to consider that forested roadless areas are rare in the Modoc. We believe that every effort should be made to preserve these wildlands for future generations. For this reason, we strongly support Alternative C as described in the EA/IS. Alternative C will provide jobs and other economic opportunities while still preserving the primitive character and ecological health of the Mount Hoffman Roadless Area. We encourage the Forest Service and Bureau of Land Management to select Alternative C as the preferred alternative in the final version of the EA/IS. D.7

Thank you for considering our comments. Please mail us a copy of the final version of the EA/IS when it is completed.

Sincerely,

Ryan Henson

Ryan Henson
Conservation Associate

cc: Rich Burns, BLM, Alturas Resource Area

CALENDAR PAGE	739
MINUTE PAGE	002222

Letter D—California Wilderness Coalition

RESPONSE TO COMMENT D.1

As discussed on page 4-42 of the EA/IS, the project area is located in a matrix area as delineated in the President Plan (also known as "Option 9" and the Northwest Forest Plan). None of the well pads are located in designated late-successional reserves, riparian reserves, or other old growth management areas. The USFS is currently in the process of delineating three late-successional territories in the Medicine Lake area. One of the proposed late-successional territories is in the vicinity of Medicine Mountain, and includes one of the proposed TCH well pads (11-24TCH). Since this well pad is located on a previously disturbed area and development of this pad would not require the clearance of late-successional or old-growth vegetation, development of this well pad would conform with applicable standards and guidelines for late-successional reserves.

The operations that would be undertaken as part of the proposed POO would be temporary and relatively short-term. After completion of the POO, a decision would be made regarding the commercial viability of the geothermal resource. If the resource is not viable, the well pads would be recontoured and revegetated. If the resource is viable and development or utilization of the geothermal resource is undertaken, certain well pads could be used for production and/or injection. However, any future use of the well pads other than the uses proposed in the POO is beyond the scope of the EA/IS, and would require additional environmental evaluation.

RESPONSE TO COMMENT D.2

The subject of performing watershed analyses before conducting management activities on National Forests was addressed in a February 21, 1995 memo from the Regional Foresters of USFS Regions 5 and 6 to the Forest Supervisors of National Forests within the two regions (USFS 1995). This memo was prepared in response to inquiries received by the USFS Issue Resolution Team regarding the requirement for watershed analyses. This requirement is contained in the *Record of Decision and Standards and Guidelines for the Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (USFS and BLM 1994). Specifically, the USFS memo addressed how the standards and guidelines for watershed analyses in this document apply to mining activities on National Forests. The USFS considers geothermal exploration activities to be a mining activity.

The USFS has determined that the standards and guidelines for watershed analyses are not rules or regulations governing National Forests; rather, these standards and guidelines are an amendment to Forest Plans (USFS 1995). Since these standards and guidelines are not rules or regulations, processing of a proposed POO for mining activities (such as the POO for the Glass Mountain Geothermal Exploration Project) cannot be delayed simply because a watershed analysis has not been completed, and the USFS must process a proposed POO within the established regulatory timeframe (USFS 1995). If it is determined upon completion of the watershed analysis that mitigation is required for a

POO that was approved during preparation of the watershed analysis, the USFS has the authority to modify the POO to include necessary mitigation measures (USFS 1995).

The EA/IS for the proposed POO contains mitigation measures to ensure that the environmental effects of the POO would be less than significant. Based on the thorough analysis of environmental issues contained in the EA/IS, it is not expected that any additional mitigation would be required for the proposed POO upon completion of a watershed analysis for the area.

The USFS, Modoc National Forest is currently in the process of conducted watershed analyses for the Modoc National Forest. A completion date for these watershed analyses has not been established at this time.

RESPONSE TO COMMENT D.3

The *Record of Decision and Standards and Guidelines for the Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (USFS and BLM 1994) do not specify that no cutting of late-successional forest is allowed, regardless of the percentage of remaining old growth acreage. Instead, it is stated on page C-44 of the *Standards and Guidelines* that, "Landscape areas where little late-successional forest persist should be managed to retain late-successional patches." This guideline pertains to late-successional stands, not individual late-successional trees, and does not prohibit any cutting of old growth trees. As stated on page 4-20 of the EA/IS, the proposed well pads and access roads would not be located in timber stands that could be considered pure old growth forest. Since the proposed project would not affect any late-successional stands, it would not be inconsistent with the management directives in the *Standards and Guidelines*, and the issue of whether the proposed project would occur in a watershed where 15% or less of the federal forest land is late-successional forest is not pertinent to the environmental evaluation of the proposed POO.

Implementation of the proposed POO would require the removal of dispersed old growth trees from well pads 46-32, 18-32, 58-6, and 56-18, and the access road to well pad 46-32. Removal of old growth trees from these locations would not be expected to adversely affect the integrity of the old growth forest in the project vicinity. A total of approximately 23 acres (not all of which contains old growth trees) would be cleared for these well pads and the access road. This affected acreage would represent an extremely small portion of the total forest that contains either old growth stands or scattered old growth trees. In addition, all of these well pads and the access road would be located near existing areas that have either been previously harvested, cleared, or otherwise disturbed.

RESPONSE TO COMMENT D.4

The survey and manage requirements referenced by the commentor are contained in the *Record of Decision and Standards and Guidelines for the Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (USFS and BLM 1994). These requirements are specifically for implementation of the

Northwest Forest Plan, not for specific projects such as the proposed POO. There would therefore be no need to follow these requirements for the proposed POO.

RESPONSE TO COMMENT D.5

The EA/IS (with these responses to public comments) addresses all applicable standards and guidelines from the President Plan. Consistent with both NEPA and CEQA, the EA/IS focuses on those standards and guidelines from the Plan that the proposed POO could conflict with if implemented. The EA/IS describes and discusses consistency with all pertinent and applicable plans.

RESPONSE TO COMMENT D.6

The USFS *Environmental Policy and Procedures Handbook* (USFS 1992) is discussed in the last paragraph on page 4-42 of the EA/IS. Chapter 20 of the USFS Handbook identifies four classes of actions that require an Environmental Impact Statement (EIS). These classes include:

- Proposed actions for which an environmental impact statement is required by law or regulation (Section 20.6.1)
- Proposals to carry out or to approve aerial application of chemical pesticides on an operational basis (Section 20.6.2)
- Proposals that would substantially alter the undeveloped character of an inventoried roadless area of 5,000 acres or more (Section 20.6.3)
- Other proposals to take major Federal actions that may significantly affect the quality of the human environment (Section 20.6.4)

Section 20.6.3 is the portion of Chapter 20 that is applicable to the proposed project. This section provides examples of proposals that would substantially alter the undeveloped character of an inventoried roadless area of 5,000 acres or more (and would therefore require preparation of an EIS). These examples include:

- Constructing roads and harvesting timber in a 56,000-acre inventoried roadless area where the proposed road and harvest units impact 3,000 acres in only one part of the roadless area
- Constructing or reconstructing water reservoir facilities in a 5,000-acre unroaded area where flow regimens may be substantially altered
- Approving a plan of operations for a mine which would cause considerable surface disturbance over 700 acres in a 10,000-acre roadless area

The first and third examples provide quantified situations that can be used for comparison purposes for the proposed project. The first example would affect approximately 5% (3,000 of 56,000 acres) of a roadless area, while the third example would affect 7% (700 of 10,000 acres) of a roadless area. The well pads and road that would be constructed in the 10,800-acre Mount Hoffman Roadless Release Area (RRA) as part of the proposed action would occupy about 12 acres, which would represent approximately 0.1% of the total acreage of the RRA. The acreage affected by the proposed project would be substantially less than the acreage affected by the project examples in Section 20.6.3 of the USFS Handbook. In

addition, these facilities would be constructed in a relatively confined area near the perimeter of the RRA, and would not affect any old growth stands.

Given the relatively small size and location of the proposed well pads and road in the Mount Hoffman RRA, the proposed project is not considered to be a proposal that would substantially alter the undeveloped character of an inventoried roadless area of 5,000 acres or more. Preparation of an EIS is therefore not necessary for the proposed POO. In addition, the proposed project would be a temporary short-term project; well pads and roads would either be reclaimed at the end of the proposed action, or additional environmental evaluation would be required for further use of the well pads and roads for geothermal activities.

RESPONSE TO COMMENT D.7

The support of the California Wilderness Coalition for Alternative C is noted.

To Randall Sharp: May 23, 1995

I am writing with regard to the geothermal well development planned for the MT Hoffman Roadless area. I am vigorously opposed to any new road construction or "high-grade" logging (i.e. logging old-growth trees) in this roadless area. Such activities would substantially alter the primitive character of this area and detrimentally affect northern Spotted owl, pine marten, goshawk, bald eagle, pileated woodpecker, and peregrine falcon habitat. Test-wells are not required in this roadless area and should be limited to areas already roaded and logged in the past. Alternative C is a superior alternative from an ecological perspective and therefore should be adopted as the "preferred" alternative. In any case, the existing "preferred" Forest Service alternative for the Glass Mountain Unit Geothermal Exploration project requires more environmental analysis before it can be legally selected. A full blown environmental impact statement is needed before the development of a roadless area can take place.

Sincerely, Todd Shuman

E.1

E.2

E.3

CALENDAR PAGE	744
MINUTE PAGE	002227

Letter E—Todd Shuman

RESPONSE TO COMMENT E.1

The opposition of the commentor to new road construction or logging in the Mount Hoffman RRA is noted. However, the level of development activity in the RRA associated with the proposed project would not be considered a substantial alteration of the undeveloped character of the roadless area (see the response to comment D.6).

It is acknowledged that development of the well pads and road in the Mount Hoffman RRA would affect habitat for certain species, including the northern spotted owl, northern goshawk, woodpeckers, and American marten (the well pads and road have not been identified as suitable habitat for the bald eagle or peregrine falcon). However, the relatively small acreage of habitat that would be affected by development of these sites would be an extremely small portion of existing habitat for these species, and these species are not known to regularly inhabit these sites. In addition, mitigation measures have been proposed in the EA/IS for the northern spotted owl, northern goshawk, and American marten to ensure that there would not be a significant effect on these species. The species would therefore not be expected to be adversely affected by the proposed action.

As discussed on page 2-2 of the EA/IS, the proposed drilling activities identified in the POO are the minimum necessary to allow for an adequate delineation of the geothermal resource. As discussed on page 2-19 of the EA/IS, elimination of exploration well pads 18-32 and 46-32 would prevent CEGC from further investigating the commercial potential of the portion of the geothermal resource that is located near Mount Hoffman. These wells would provide more complete data regarding geologic and hydrologic systems in the Medicine Lake vicinity, and subsurface geological information would be collected during testing at these wells. This information is considered to be necessary for the following reasons:

- It will allow CEGC to adequately assess the high heat flow area in the Mount Hoffman region for resource production
- It will allow CEGC to develop an adequate three-dimensional model of the geothermal reservoir

CEGC has sited well pads 18-32 and 46-32 to obtain the necessary information regarding the geothermal resource in the vicinity of Mount Hoffman while avoiding environmentally sensitive areas to the greatest extent possible. The specific sites for well pads 18-32 and 46-32 were selected by CEGC through consultations with the USFS and wildlife biologists. These well pad sites were chosen primarily because they contain a minimum of the necessary habitat components for sensitive wildlife species such as the northern spotted owl. By avoiding wildlife habitat components, potential effects on wildlife habitat from POO implementation would be minimized. There are no previously disturbed pad locations in the immediate Mount Hoffman vicinity that could be drilled (either directionally or conventionally) and used to adequately test the geothermal resource in this area.

RESPONSE TO COMMENT E.2

The support of the commentor for Alternative C is noted.

RESPONSE TO COMMENT E.3

Given the relatively small size and location of the proposed well pads and road in the Mount Hoffman RRA, the proposed project is not considered to be a proposal that would substantially alter the undeveloped character of the Mount Hoffman RRA. Preparation of an EIS is therefore not necessary for the project (see the response to comment D.6).

May 5, 1995

Dear Mr. Sharp,

I wish to strongly urge the Modoc National Forest to restrict geothermal well-drilling to areas outside of the Mt. Hoffman Roadless area. Along these lines, I wish to urge adoption of Alternative C, not the Preffered Alternative. The Modoc has few large roadless areas, protection of this area is important for wildlife. Thank you for your consideration. F.1 F.2

Sincerely,

Joel Despain

HCR 89 Box 211
Three Rivers, CA 93271

Letter F—Joel Despain

RESPONSE TO COMMENT F.1

The opposition of the commentor to geothermal well drilling in the Mount Hoffman RRA is noted.

RESPONSE TO COMMENT F.2

The support of the commentor for Alternative C is noted.

928 Oak Ridge Road
Los Gatos, CA. 95030
May 13, 1995

Mr. Randall Sharp
Modoc National Forest
800 West 12th St.
Alturas, CA 96101

Dear Mr. Sharp:

I am writing to strongly oppose proposed geothermal test wells in the Mount Hoffman Roadless Area. While I do support geothermal test wells in roaded areas, I object to any logging of old-growth trees or road construction within the Roadless Area in support of these wells. G.1

I believe that an environmental impact statement need be developed prior to developing the roadless area. I believe it would make a lot more sense to adopt alternative C (drilling proposed wells only in previously logged areas that already have roads) as the preferred alternative in the final version of the EA. G.2 G.3

Thank you for your consideration.

Sincerely,

John Miller

Letter G—John Miller

RESPONSE TO COMMENT G.1

The opposition of the commentor to geothermal well drilling in the Mount Hoffman RRA is noted.

RESPONSE TO COMMENT G.2

Preparation of an EIS is not necessary for the proposed project or for the proposed well pads and road in the Mount Hoffman RRA (see the response to comment D.6).

RESPONSE TO COMMENT G.3

The support of the commentor for Alternative C is noted.

Letter H

Stephen Buckhout
1389 Heckman Way
San Jose CA 95129-4109

May 9, 1995

Randall Sharp
Modoc National Forest
800 W 12 th Street
Alturas CA 96101

Dear Mr. Sharp:

Re: Glass Mountain
Unit Geothermal
Exploration Project

I am writing to request that the Forest Service select Alternative C as the Preferred Alternative in the final version of the Environmental Assessment. H.1 I am opposed to logging any old-growth trees or constructing any new roads within the Mount Hoffman Roadless Area. H.2

Should some other Alternative be selected which will lead to development of the Roadless Area, please be reminded that Forest Service regulations require the preparation of an Environmental Impact Statement since development would substantially alter the primitive character of the roadless area. H.3

Thank you for your attention to this matter.

Sincerely,

Letter H—Stephen Buckhout

RESPONSE TO COMMENT H.1

The support of the commentor for Alternative C is noted.

RESPONSE TO COMMENT H.2

The opposition of the commentor to project activities in the Mount Hoffman RRA is noted.

RESPONSE TO COMMENT H.3

Given the relatively small size and location of the proposed well pads and road in the Mount Hoffman RRA, the proposed project is not considered to be a proposal that would substantially alter the undeveloped character of the Mount Hoffman RRA. The proposed project is a short-term, temporary project that includes exploration activities, rather than development activities. Preparation of an EIS is therefore not necessary for the project (see the response to comment D.6).

Letter I

Rosanna DiBiase-Ferrera
829 B San Anselmo Ave.
San Anselmo Ca. 94960

May 3 , 1995

Dear Mr. Sharp,

I am writing to strongly request that the Forest Service:

- avoid any logging of old growth trees or constructing any new roads within the Mt. Hoffman Roadless Area; I.1
- prepare an environmental impact statement prior to developing the roadless area; and I.2
- adopt alternative C as the preferred alternative in the final version of the EA. I.3

As representative John Porter stated last year regarding road construction in these areas, "Roadless regions exemplify the least...disturbed forest and stream systems, the last reservoirs of ecological diversity, and the primary benchmark for restoring ecological integrity. "

We face extraordinary decisions in our time which shall be felt by many generations to come. If we "harvest " the last remaining true wilderness areas of our time and in so doing foil it's potential for regeneration, what is the legacy we leave to our children? The time is now to begin to act out of a restorative perspective. It is our calling to search our hearts and our awareness for alternatives which will not further jeopardize the balance of nature! I.4

Please, I urge you to act in favor of these requests!

Respectfully,

Rosanna DiBiase-Ferrera

Letter I—Rosanna DiBiase-Ferrera

RESPONSE TO COMMENT I.1

The opposition of the commentor to project activities in the Mount Hoffman RRA is noted.

RESPONSE TO COMMENT I.2

Preparation of an EIS is not necessary for the proposed project or for the proposed well pads and road in the Mount Hoffman RRA (see the response to comment D.6).

RESPONSE TO COMMENT I.3

The support of the commentor for Alternative C is noted.

RESPONSE TO COMMENT I.4

As discussed on page 2-2 of the EA/IS, the proposed well sites have been selected to minimize the amount of new surface disturbance and tree removal. With the exception of well pad 46-32, all wells would be at least partially located on old log landings, logging roads, or in previously clear-cut areas; these areas all have been subject to surface disturbance in the past. New access roads have been routed as directly as possible to minimize surface disturbance. Within the Mount Hoffman RRA, the well pads and road that would be constructed would occupy about 12 acres, which would represent approximately 0.1% of the total acreage of the RRA. As discussed on page 4-20 of the EA/IS, the proposed project would not affect stands of old growth trees or the integrity of the old growth forest in the project vicinity.

As discussed on page 2-17 of the EA/IS, reclamation and revegetation of well sites and access roads would occur upon completion of the proposed action. CEGC would be responsible for posting reclamation bonds to ensure that all project activities would be reclaimed in a timely manner following project completion. Well pads and access roads would be recontoured to their approximate pre-project contours and scarified where necessary to loosen the top soil. Any topsoil stockpiled during construction would be replaced, and the well pads and access roads would be reseeded and planted with native vegetation. This would assist in regeneration of forest vegetation, and would avoid any long-term effects from the project.

May 4, 1995

Randall Sharp
Modoc National Forest
800 West 12th Street
Alturas, CA 96101

Re: Mount Hoffman Roadless Area

Dear Mr. Sharp:

I am writing to request that the Forest Service:

1. avoid logging any old-growth trees or constructing any new roads within the Mount Hoffman Roadless Area; J.1

2. prepare an environmental impact statement prior to allowing any development in the roadless area; and J.2

3. adopt alternative C as the preferred alternative in the final version of the recently released environmental assessment for the Glass Mountain Unit Geothermal Exploration Project. J.3

Thank you for your consideration of these requests.

Sincerely,

John Copoulos

John Copoulos
226 Page Street
San Francisco, CA 94102

Letter J—John Copoulos

RESPONSE TO COMMENT J.1

The opposition of the commentor to project activities in the Mount Hoffman RRA is noted.

RESPONSE TO COMMENT J.2

Preparation of an EIS is not necessary for the proposed project or for the proposed well pads and road in the Mount Hoffman RRA (see the response to comment D.6).

RESPONSE TO COMMENT J.3

The support of the commentor for Alternative C is noted.

PHONE/FAX: 916-852-8990

Letter K

3 May 1995

Mr. Randall Sharp
Modoc National Forest
800 West 12th Street
Alturas, CA 96101

Dear Mr. Sharp,

RE: Glass Mountain Unit Geothermal Exploration Project EA

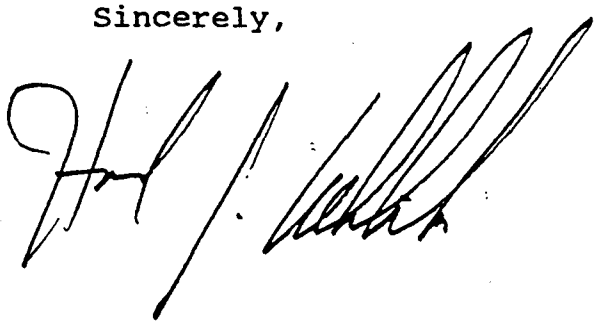
With regard to the project, please do the following:

1) avoid logging any old-growth trees or constructing any new roads within the Mount Hoffman Roadless Area; K1

2) prepare an environmental impact statement prior to developing the roadless area; K2

3) adopt Alternative C as the preferred alternative in the final version of the EA. K3

Sincerely,



CALENDAR PAGE	757
MINUTE PAGE	002240

Letter K—H. J. Whitaker

RESPONSE TO COMMENT K.1

The opposition of the commentor to project activities in the Mount Hoffman RRA is noted.

RESPONSE TO COMMENT K.2

Preparation of an EIS is not necessary for the proposed project or for the proposed well pads and road in the Mount Hoffman RRA (see the response to comment D.6).

RESPONSE TO COMMENT K.3

The support of the commentor for Alternative C is noted.

To ensure that the federal agencies provide the appropriate distribution of future information regarding the proposed geothermal drilling within the Glass Mtn. KGRA, please verify the following information and complete the questionnaire. The return address is printed on the other side of this form.

Name:

Vivian Wells
6324 Shasta Way
Klamath Falls, OR 97603

— I will be forwarding my (our) comments to you regarding the proposed geothermal project within the Glass Mountain KGRA.

X Please include my (~~our~~) name on all future mailing lists for this project or similar activities within the Glass Mountain KGRA.

— I am not interested in receiving further information regarding the current proposed geothermal project or any other similar projects within the Glass Mountain KGRA.

X I have the following specific comments regarding the geothermal proposal:

1. You have stated the proposed core holes and the wells will not affect Medicine Lake levels of water or the levels in Homeowners wells. What is your action plan if the Lake level drops and/or water levels drop in Homeowners wells?? L1

2. What are you planning to do with the Timber you harvest when clearing the sites for the core holes and the wells. L2

Signed: Vivian Wells

Letter L—Vivian Wells

RESPONSE TO COMMENT L.1

As discussed in the EA/IS and the responses to comments A.7 and B.3, the proposed project would not significantly deplete water resources in the project vicinity, and would not significantly affect water levels at Medicine Lake or in the wells of homeowners near Medicine Lake. As noted in the response to comment A.7, the groundwater body that makes up Medicine Lake and provides water for homeowner wells is a perched, fairly well-contained groundwater body. This groundwater body overlies and is separated from the deeper regional water body that would be tested as part of the proposed POO. Geothermal activities proposed under the POO would therefore not be expected to affect the groundwater body that makes up Medicine Lake or provides water for homeowner wells.

The only project activity that could affect the perched groundwater body would be pumping of groundwater from the two existing water wells in the Arnica Sink area to supply water for drilling needs and dust control. As discussed on page 4-8 of the EA/IS, this pumping would be of short duration, would utilize an extremely small amount of the groundwater that is available in the perched groundwater body, and would be spread out over time. Significant drawdown of this groundwater body from groundwater pumping associated with the POO would therefore not be expected.

Although the POO is not expected to affect water levels at Medicine Lake or in the wells of homeowners near Medicine Lake, if the USFS is notified by homeowners that water levels in their wells are dropping after implementation of the POO, the USFS would investigate if the drop in water levels is due to the proposed project. The USFS would consider such factors as weather and recent precipitation (e.g., drought conditions), changes in runoff patterns, and other water withdrawals in the basin. In the unlikely event that the drop in water levels is due to the POO, the USFS could require that CEGC reduce their pumping of groundwater from the groundwater body that makes up Medicine Lake and provides water for homeowner wells.

RESPONSE TO COMMENT L.2

As discussed on page 4-19 of the EA/IS, all timber removal at the well pads and access roads would be conducted in accordance with USFS specifications. In accordance with USFS requests, CEGC would avoid conifer species over 14 inches dbh where feasible. It is expected that commercial timber (i.e., timber with at least a 4-inch dbh on the short end and over 20 feet long) would be limbed and decked for later removal and sale.

In addition, existing brush and downed logs at the well pads would be used to create concentrated wood debris piles that will serve as denning sites for the American marten (see Mitigation Measure 4.5.4 on pages 4-26 to 4-27 of the EA/IS). These piles will provide compensation for removal of American marten habitat. Brush, saplings, and tree limbs from timber removal at the well pads may also be used to create the denning sites.

Remaining brush, removed tree limbs, and other vegetation that is not viable for commercial sale or American marten habitat creation would be scattered in surrounding areas, piled and burned at the well pads, or buried as appropriate at locations designated by the USFS. Tree stumps would be disposed of at a USFS-designated site and would not be buried at the well pad sites.

Letter M

Mr. John R. Swanson
3400 Edmund Blvd.
Minneapolis, MN 55406

May 17, 1995.

Modoc National Forest
800 West 12th St.
Alturas, California 96101.

Dear Sirs:

Please accept my following COMMENTS concerning the Proposal to Drill Wells in the Mount Hoffman Roadless Area.

I am opposed to geothermal and other mining activities in this general area, as such activities will destroy soil, water, vegetation, wildlife, roadless, and recreation attributes of importance. M.1

May I suggest the following:
a Wildlife Habitat Preserve,
to save the marten, northern spotted owl, goshawk, bald eagle, pileated wood pecker, and peregrine falcon.
to include all old growth in a National Old-Growth Preservation System.
and to designate the Mount Hoffman - Glass Mountain Wilderness, of 15,103 Acres. M.2
to consider that the Medicine Lake area is unique, varied, and fragile, and of certain national significance as the Medicine National Monument and Wilderness of (at least) 43,000 Acres, with the initial Wilderness of 28,000 Acres
to promote biological diversity and ecosystem conservation.

So as to fully benefit man, and all life!

Sincerely,

John R. Swanson.

CALENDAR PAGE	762
MINUTE PAGE	002245

Letter M—John R. Swanson

RESPONSE TO COMMENT M.1

The opposition of the commentor to geothermal activities in the Mount Hoffman RRA is noted. As discussed in the EA/IS, proposed geothermal exploration activities in the Mount Hoffman RRA would not have a significant adverse effect on soil, water, vegetation, wildlife, or roadless and recreational attributes.

RESPONSE TO COMMENT M.2

The suggestion for creation of a wildlife habitat preserve, wilderness area, and/or National Monument is noted. However, consideration of such a special status area by the USFS (which serves as the land manager for the Modoc National Forest) is outside the scope of the EA/IS for the proposed POO. As discussed in the second paragraph on page 3-26 of the EA/IS, the Mount Hoffman area is a Roadless Release Area (RRA), which means that the area has been released from current consideration for designation as a Federal Wilderness Area. The Mount Hoffman RRA was evaluated for Wilderness Area status as part of the 1978 Roadless Area Review and Evaluation (RARE) by the USFS (USFS 1991a). As a result of the RARE, five roadless areas were incorporated into the existing South Warner Wilderness on the Modoc National Forest. All other roadless areas (including the Mount Hoffman RRA) were released from wilderness consideration for the 15-year planning period of the *Modoc National Forest Land and Resource Management Plan* (USFS 1991a).

As discussed in Section 4.5, Biology, of the EA/IS, implementation of the proposed POO (with mitigation) would not have a significant effect on wildlife species such as the American marten, northern spotted owl, northern goshawk, bald eagle, pileated woodpecker, or peregrine falcon. In addition, stands of old growth trees in the Forest would not be affected by the proposed project.

References

BLM (U.S. Bureau of Land Management) and U.S. Department of Agriculture, Forest Service (USFS). 1984. *Geothermal Leasing of National Forest Lands in the Glass Mountain Known Geothermal Resource Area Supplemented Environmental Assessment*. September 1984.

CEGC (California Energy General Corporation). 1994. *Plan of Operations for Exploration Drilling, Glass Mountain Area, Siskiyou County, California*. May 1994.

USFS. 1991a. *Modoc National Forest Land and Resource Management Plan*. 1991.

_____. 1991b. *Modoc National Forest Land and Resource Management Plan Final Environmental Impact Statement*. 1991.

_____. 1992. *Environmental Policy and Procedures Handbook*. September 21, 1992.

_____. 1995. Interoffice Memo from G. Lynn Sprague (Regional Forester for USFS Region 5) and John E. Lowe (Regional Forester for USFS Region 6) to the Forest Supervisors of National Forests in Regions 5 and 6. February 21, 1995.

USFS and BLM. 1994. *Record of Decision and Standards and Guidelines for the Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl*. April 1994.